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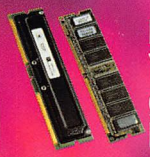

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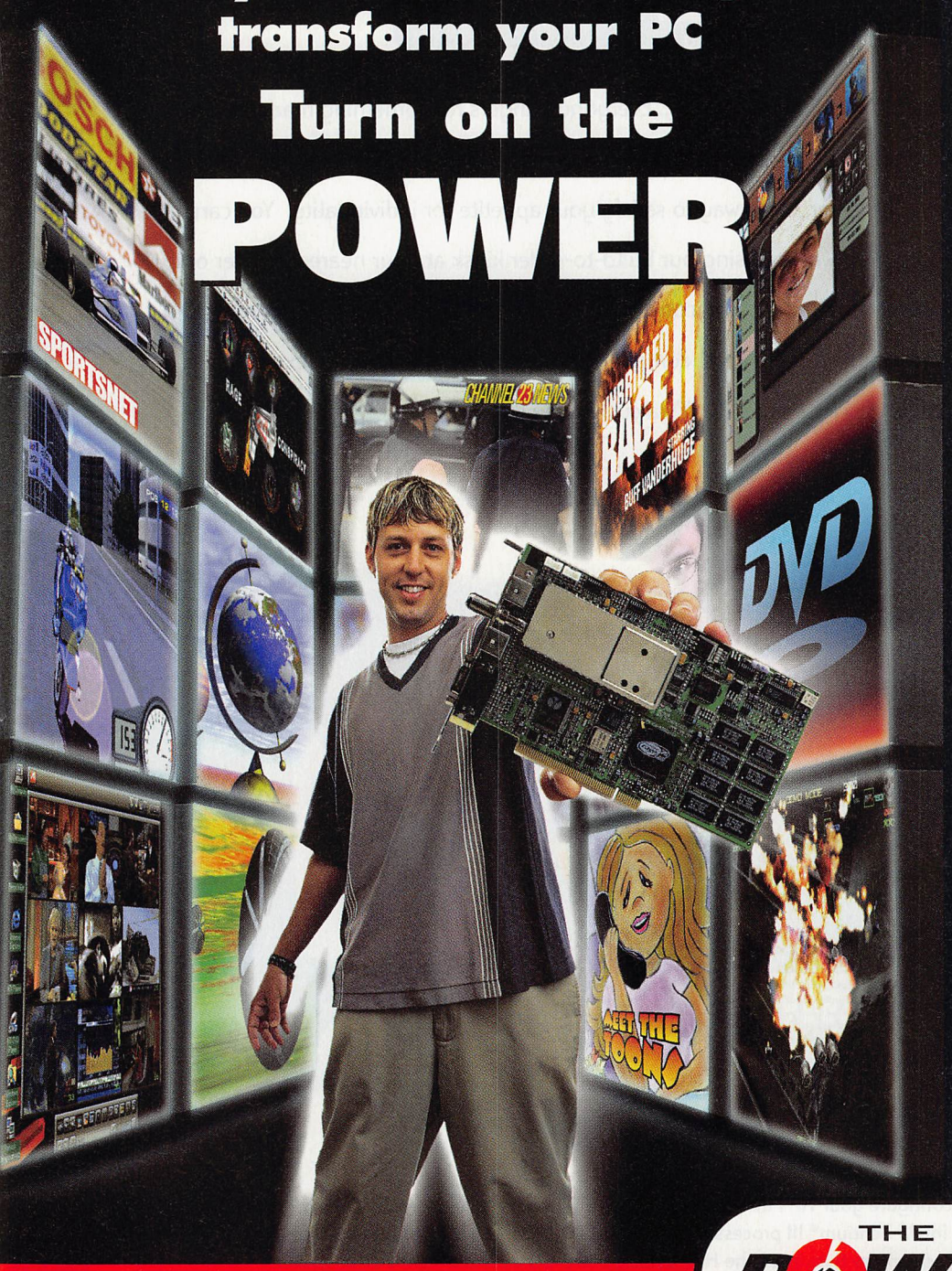

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► NOVEMBER 1999

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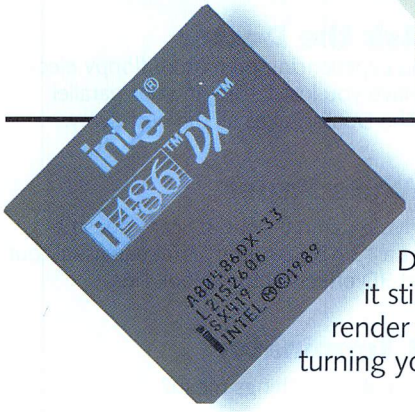

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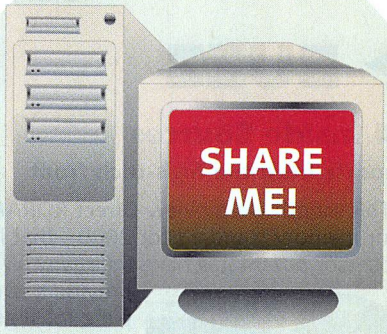

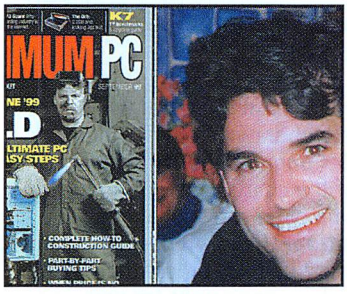

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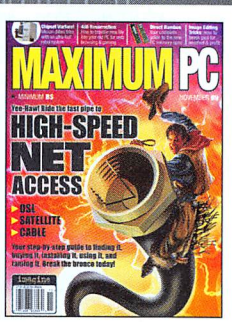

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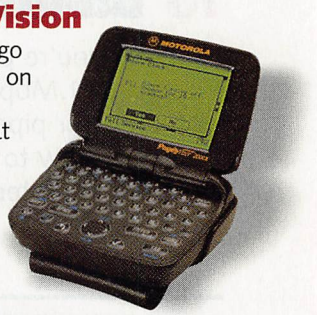

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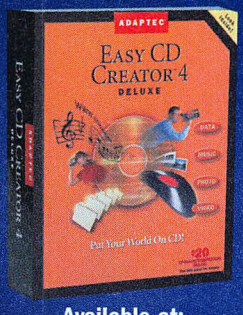

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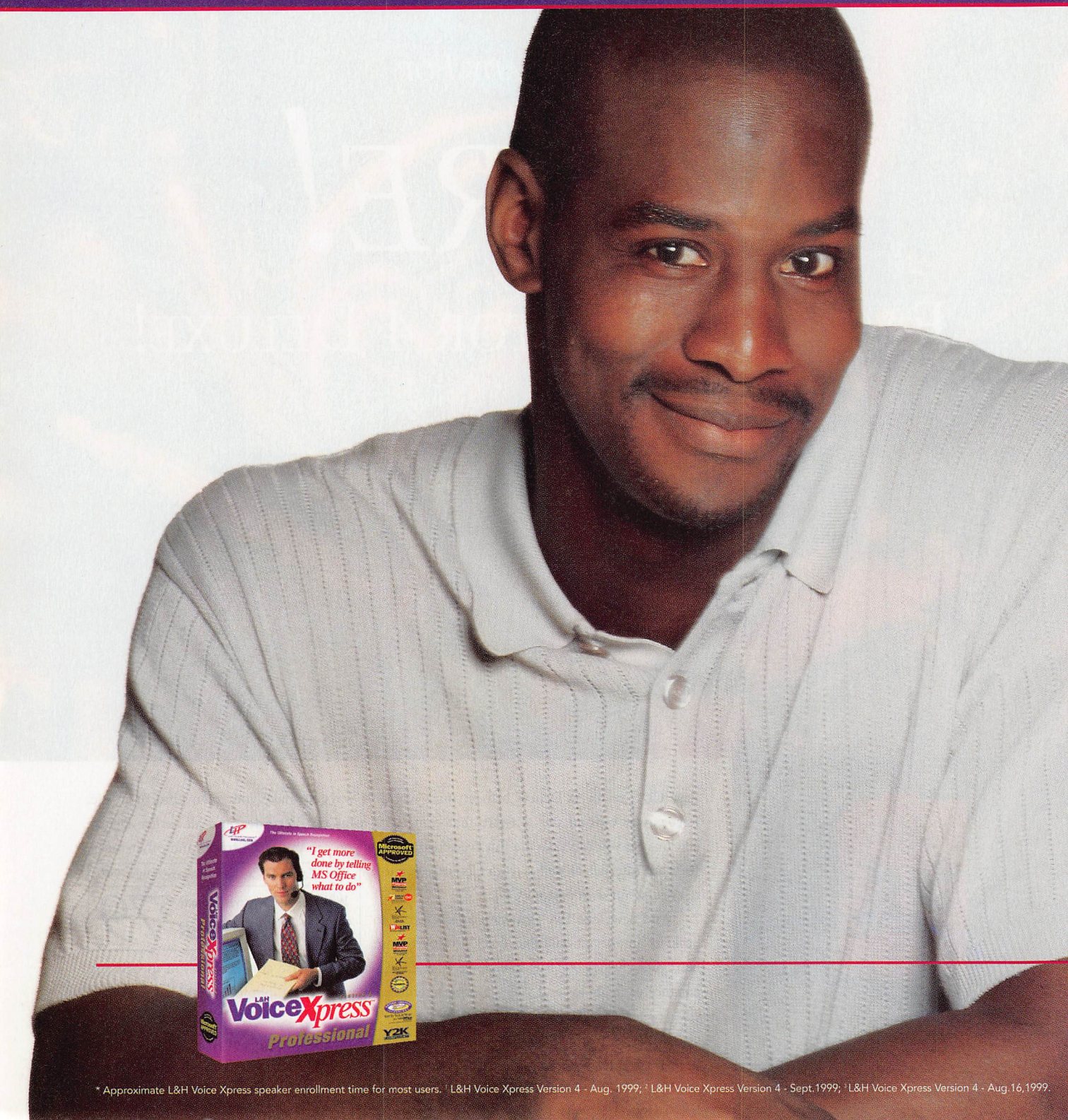

* Approximate L&H Voice Xpress speaker enrollment time for most users. [1] L&H Voice Xpress Version 4 - Aug. 1999; [2] L&H Voice Xpress Version 4 - Sept.1999; [3] L&H Voice Xpress Version 4 - Aug.16,1999.

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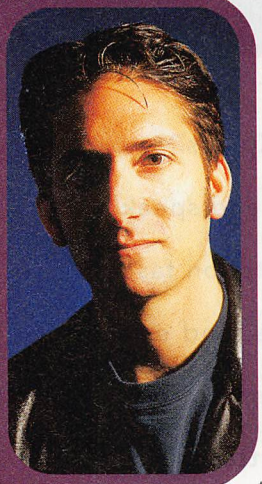

Hello, my name is Jon Phillips. You might recognize me from such hit *Maximum PC* productions as "Pentium III: Katmai Cometh," "Athlon: It's a Hit," and "Bitchin'*fast*!3D^{2000}." For the last three years, as the executive editor of both this magazine and its predecessor, *boot*, I've developed each issue's feature stories, reported on CPU and display technology, and written the Glitch satire column. This month, I'll be taking the helm from outgoing big-daddy-in-chief Brad Dosland, and running the show at *Maximum PC*.

If you read Brad's October goodbye column, you're already aware of the "transfer of power." Sure enough, steering *Maximum PC* is a great responsibility and I don't bear it lightly. During the last month, I've spent long hours thinking about how we can make the magazine even better. You, meanwhile, have probably been wondering what's in store for the magazine.

Well, fear not, pilgrims of Pure PC Power. The *Maximum PC* juggernaut is primed for even more momentum. We'll continue to brutalize feeble, wack hardware; we'll continue to help you tweak your machine for power and reliability; and we'll continue to show you how to get the most out of your favorite games, apps, and utilities. In fact, beginning in this issue, we've expanded our "how-to" coverage by replacing the three-page 12-Step department with *13 pages* of PC schoolin' in the features section.

Upper-echelon power users will also be happy to see the fortification of our White Paper and Lab Notes departments. Not only will these departments teach you how PCs function and perform on a technical level, they'll also describe how technology issues factor into your buying decisions. To the devil with any vendor who dares deceive the *Maximum PC* faithful with technical doublespeak!

Besides adding product previews to our Inside Sources department, and infusing the entire magazine with more humor and what marketing executives like to call "testicular cajonification," you should find that *Maximum PC* will continue to be the same magazine you've always known and loved. We did indeed relegate our Interrogation interview to semi-regular status, but we're filling its spot with extra content that should directly benefit your everyday, PC hardware-hacking hi-jinks. We also traded in Shel Kimen's industry-oriented On the Line column for Sherry Monarko's Net Sensei column. Our chief web page designer will show you how to get the most satisfaction from your time online.

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The folks who work for *Maximum PC* are a bunch of regular guys and gals who like tinkering with computers and sharing what they learn with others—other editors, friends and family, and readers around the world. It's called "geeking out," and it's what we do best. When an editor reviews a new product, you can rest assured that he or she conducted all testing him or herself—what better way to uncover hidden flaws, and gain insight into how PCs actually work? You betcha: *Maximum PC* is a hotbed of PC dissection, PC benchmarking, and PC rant-festing.

Oh yes, we *do* have the passion. But you have your own unique perspective. Do your part as the 11th member of the *Maximum PC* staff, and tell us what you want to see uncovered in the pages of this magazine. It's your mag as much as ours.

The email address is **editor@maximumpc.com**. Geek at will.

Jon Phillips
Editor in Chief

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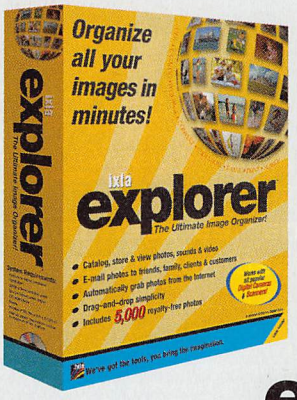

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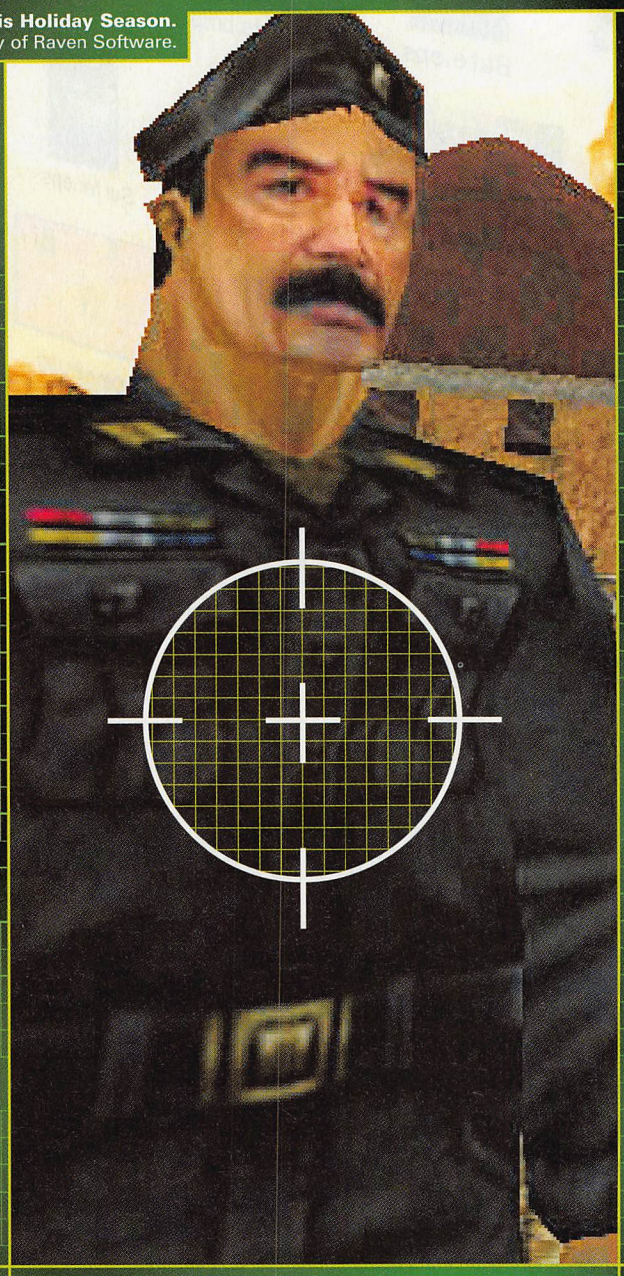

THE "KILL-ZONE" AS SEEN BY THE 2000 DPI RAZER™ BOOMSLANG™.

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[dead player index]

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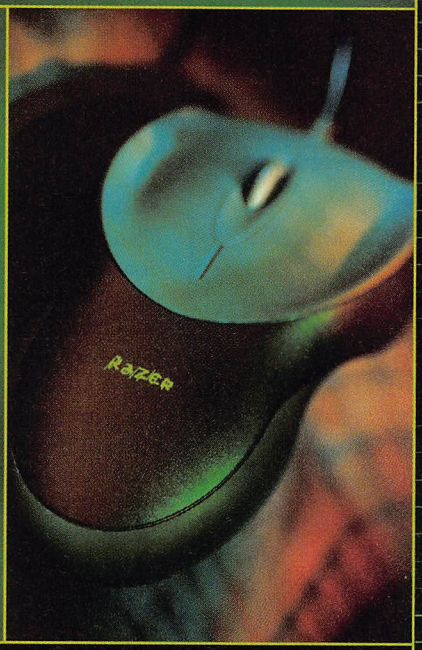

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COMMPORT

It's Obvious You Think Hilary Rosen Is Full of Crap

Last month's most passionate e-mails responded to comments made by Hilary Rosen, president of the Recording Industry Association of America, in our September Interrogation interview. In fact, every individual who wrote in took umbrage at Rosen's remarks about the free distribution of MP3s on the Internet.

We were also awash in a deluge of letters asking where we found a 256MB DIMM of PC133 SDRAM for the low, low price of $174, as reported in the September "Dream Machine" feature. Fact is, we goofed. Corsair Micro doesn't sell such a stick. As this issue went to press, 256MB DIMMs of myriad specifications ranged in price from $394 to $1,039, according to quotes from **www.pricewatch.com**.

Before delving into this month's letters, we're announcing a new Commport feature: Reader of the Month. Using our most subjective judging criteria, we will recognize readers who: 1) demonstrate superlative passion for pure PC power; 2) show amazing commitment to the *Maximum PC* magazine and web site; or 3) send us the single most compelling, insightful e-mail of the month.

November's Reader of the Month is Peter Nisita, 18, of Huntington, NY. Also known as "Ou2mame," Nisita is a full-time hardware hacker and possibly the most frequent contributor to *Maximum PC*'s online forums. But even more importantly, Ou2mame gave J.P. the inspiration for September's Glitch column.

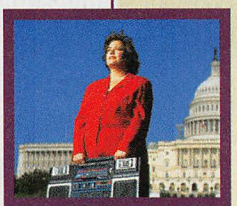
If you have a killer idea for Glitch or any other part of the magazine, send it to **editor@maximumpc.com**. And with that, our mail bin...

Hilary on the Pillory

I'm no economics major but I have to completely disagree with Hilary Rosen's assessment that CDs aren't overpriced. Unless they're promoting a new release with a "sale" at $12.99 or $13.99, stores consistently price CDs at $15.99 or $16.99. With tax, that pretty much equals the same inflated prices of 15 years ago.

Bottom line: Stop trying to explain away MP3 users as thieves in the night, and instead fix your own industry methods. Otherwise, the Robin Hoods will continue to grab a little economic justice from the music industry's King Johns, whether it means trading in bootleg tapes, DATs, recordable CDs, or MP3s. Lower your prices and I will happily buy more of my CDs new, and simply burn MP3 compilations of my favorite songs onto CDs for my car stereo.

—Raif Copeland



"I'm a CD fan myself, Hilary, but MP3 is here to stay."

In response to the interview with Hilary Rosen: Would somebody please correct this idiot? She complains that MP3 music is not CD quality. Bull. If you encode an MP3 at 128KB/44KHz, you get music that is so near to CD quality, the difference is very, very minimal. She also claims that people would rather listen to music on their stereo. Well, if your stereo has auxiliary input (which most do), and you have $5 for some wiring and connectors, bam, you've got your stereo pumping out sound from your computer.

With that said, I think most people who use MP3s would agree that MP3s don't stop anyone from buying full-album CDs. Instead, it gives us a way to get the tracks we want without having to buy overpriced CD singles.

—Justin Mullis

Hilary Rosen states people would probably buy a CD instead of downloading an MP3 because of its "value-adds"—lyrics, packaging, and other information about the artist. Let me burst her bubble.

First, from the Internet you can almost get all the lyrics of virtually every song ever recorded. Second, the lack of packaging is one of MP3's strengths. No CDs to physically swap in and out, nothing to carry. And third, liner notes could easily be distributed on a universal format like Adobe *Acrobat* or HTML, and printed on a color inkjet. Record companies would actually make more money selling the music and booklet docs online instead of in a costly "platter with booklet" plastic pack.

I'm a CD fan myself, Hilary, but MP3 is here to stay. Regulate the technology instead of trying to ban it.

—Wabash

Obscene Machine 99

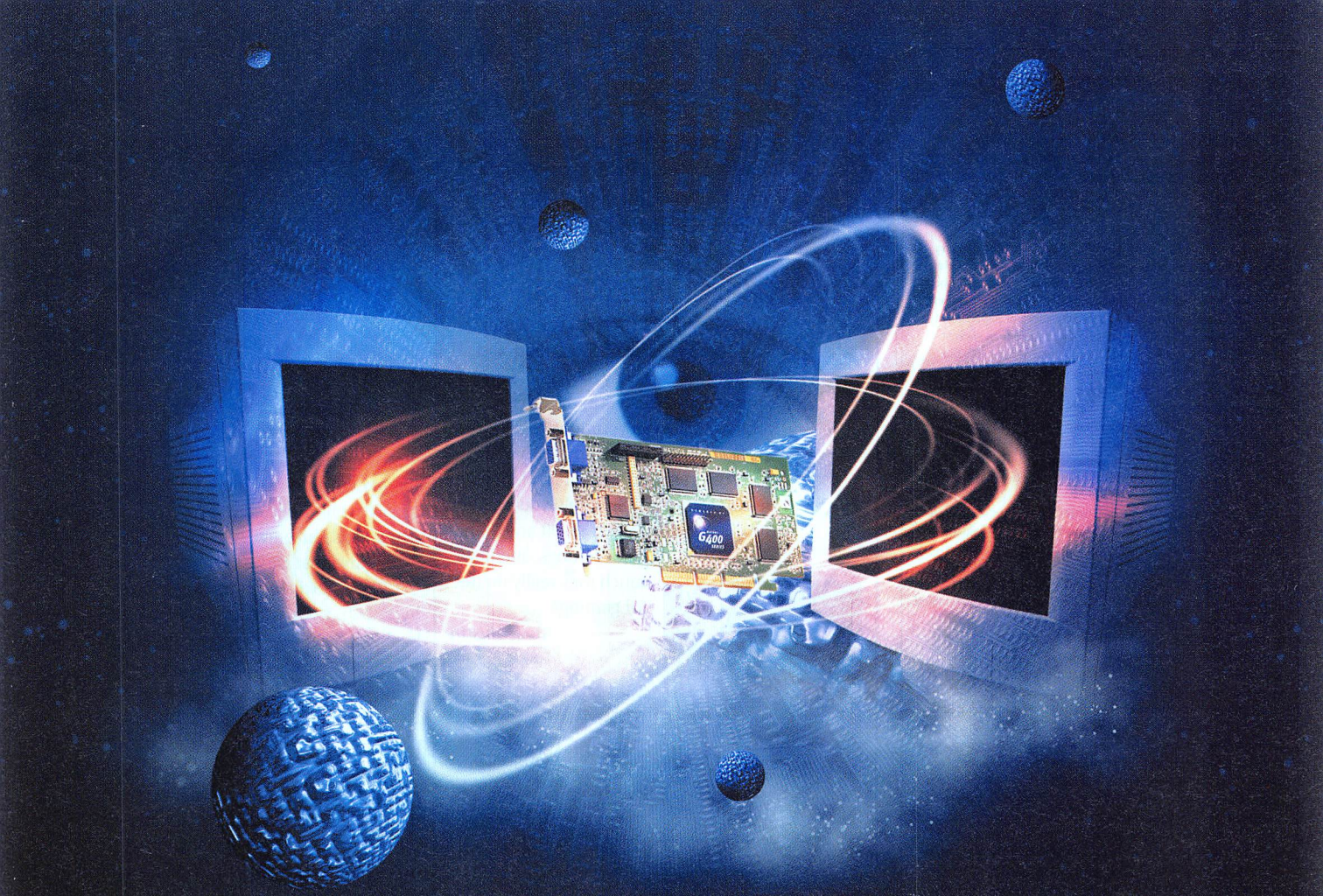
I just finished reading your September Dream Machine "Build It" article. It was informative as well as intense, and I needed a towel and a cigarette after the experience. The hints you provided not only assisted me in putting together my new PC, but also brought newfound adventure to my marriage. For example:

"Just unscrew the mounting tray and lay it on a flat, well-lit surface, such as your kitchen table."... "Once they're erected, you should rock the posts back and forth."... "Two screws on one side and one on the other should suffice."

I would love to continue, but my wife is getting the mounting tray so she can rock my post.

—K. Aleem

Editorial Policy: Maximum PC invites letters to the editor; just send 'em to **commport@maximumpc.com**. Please include your full name, home town, and telephone number. Letters may be edited for space and clarity. Due to the vast amount of e-mail we receive, we cannot personally respond to each letter.



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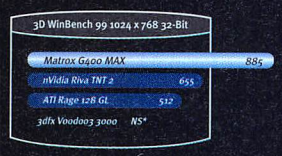

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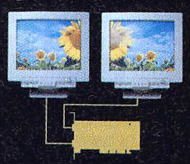

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Features advertised are for retail products only and may not apply to bulk versions. Please refer to original retail packaging for details. For performance benchmark details refer to www.matrox.com/mga/intermediate/lineprint/ *The 3dfx Voodoo3 3000 does not support 32-bit rendering.

HP CD-Writer Sweepstakes Official Rules

NO PURCHASE NECESSARY TO ENTER OR WIN. SWEEPSTAKES BEGINS AT 12:01 AM PACIFIC DAYLIGHT TIME (PDT) ON 8/1/99. SWEEPSTAKES ENDS AT MIDNIGHT PACIFIC STANDARD TIME (PST) ON 1/31/00. SPONSOR: HEWLETT-PACKARD, INFORMATION STORAGE AMERICAS, 815 14TH STREET SW, LOVELAND, CO 80537.

There are two ways to enter the sweepstakes. Method #1: Online: Access the Hewlett-Packard web site by typing www.hpcdwriter.com/go/maxpc, follow all instructions and complete the online entry form. Incomplete entries will not be eligible. Method #2: By Mail: Hand-print your name, address, telephone number and e-mail address (if you have one) on a plain piece of paper. Insert your mail-in entry in a #10 business envelope and mail via First Class Mail to: Hewlett-Packard CD-Writer Sweepstakes, P.O. Box 9203, Medford, NY 11763-9203. Limit: one entry per person or e-mail address. In the case of multiple entries only the first entry will be accepted. In the event of a dispute over the identity of an online entrant, entry will be deemed submitted by the holder of the e-mail account. Use of automated devices not valid for entry. All entries become the property of the Sponsor and will not be returned. All entries must be received by or between 8/1/99 and 1/31/00.

Random drawings to award all prizes will be conducted on or about 2/18/99 under the supervision of an independent judging organization whose decisions are final and binding in all matters related to the sweepstakes.

Prizes: Eight (8) Hewlett-Packard CD-Writer Plus M820e's (approximate value: $599 each). Total value of all prizes guaranteed to be awarded: $4,792. Prizes are not transferable or redeemable for cash. Sponsor reserves the right to substitute a prize of equal or greater value in the event a prize is unavailable. Winners are responsible for all taxes on prizes. Limit: one prize per household. By participating in this sweepstakes all participants agree that all prizes are awarded upon the condition that the Sponsor and their respective agencies or employees will have no liability whatsoever for any injuries, losses or damages of any kind resulting from the acceptance, possession or use of any prize. The Sponsor does not make, nor in any manner will be responsible for, any warranty, representation or guarantee relating to each prize provided; however, each prize will be subject to Hewlett-Packard's standard warranty.

Winners will be notified by mail. Winners may, at the sole discretion of the judges, be required to sign and return an Affidavit of Eligibility/Liability/Publicity Release within 14 days of date printed on notification or he/she will be disqualified. Any prize or prize notification returned as undeliverable will result in disqualification, and the corresponding prize will be awarded to an alternate winner in a random drawing. Acceptance of prize constitutes permission (except where prohibited by law) to use winners' names, prizes won, voices, hometowns and likenesses for purposes of advertising, trade, online posting, promotion and publicity without additional compensation.

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For a list of winners (available by 4/18/00) send a self-addressed, stamped envelope by 1/31/00 to: Hewlett-Packard CD-Writer Sweepstakes Winners, P.O. Box 9204, Medford, NY 11763-9204.

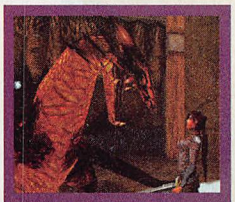
COMMPORT

Associate Editor Josh Norem replies: It's a good thing we didn't include instructions on the best method for inserting your 3.5-inch floppy.

Color Matters

I thought that 32-bit color was better than 16-bit color. Well, my friend said that they were exactly the same. That confused me because in the 3dfx Voodoo^3 review in your July 99 issue you wrote, "It is hard to recommend a card that doesn't support 32-bit rendering or AGP texturing." So, could you explain the difference between 32-bit and 16-bit color settings, and how much they really matter for gaming?

—Justin



"Game designers are just beginning to increase the source-color depth of both textures and visual effects."

Departments Editor Sean Downey replies: The terms 16-, 24-, and 32-bit color refer to how many bits of color information are assigned to each pixel on your screen. 16-bit color is capable of representing 65,536 different colors, and both 24- and 32-bit color yield an available range of 16.7 million colors. The 8-bit difference between 24- and 32-bit color is accounted for by an 8-bit alpha channel, which yields 256 levels of transparency.

Your friend is probably trying to tell you that for most games, the difference between 16- and 32-bit color is negligible, since the games themselves weren't designed with 32-bit color in mind. Game designers are just beginning to increase the source-color depth of both textures and visual effects in their games. For example, videocards capable of 32-bit color will display games such as *Battlezone II* and *Quake III Arena* at their very best.

One of the things that stops me from recommending the Voodoo^3 is its 16-bit color limitation, which introduces ugly dithering effects when attempting to display the smooth color transitions available in 32-bit games. If you want to know more about 3D terminology, check out this month's White Paper on page 93.

The Write Stuff

According to two of my friends who recently purchased CD-RWs, burning audio at 2x will produce better sound quality than burning at 4x. I argue that since it is digital, it shouldn't matter. What's the truth?

—Ryan Birtles

Departments Editor Sean Downey replies: Burn speeds shouldn't make any difference in the sound quality of the final CD. Audio quality is only affected when you're doing a disc-at-once burn from a CD-ROM drive that can't keep up with the CD-R. To avoid any errors, you should try to burn from a source drive that is at least twice as fast as your burn speed.

A more relevant concern is, how well does your playback device handle a 4x or 8x audio disc? Older or substandard CD players and CD-ROM drives may not reliably retrieve audio tracks notched at speeds higher than 2x. If you're concerned about this, just do some test burns at different speeds and drop them into the oldest CD player you have. Personally, I always burn audio discs at 1x and I've never had a problem. But I'm a little superstitious when handling my delicate audio files.

Someone's Been Doin' Ia Cracka-di-Coca

On page 112 of the September issue, Jon Phillips gave a quick review of an awesome video card. Could you please e-mail me the info on where I can get this card? I tried every damn search engine, but couldn't find it.

—FrOzN

Editor-in-chief Jon Phillips replies: Our chilly-chill pal FrOzN isn't alone—a number of readers have e-mailed us for more information on Video Loca's Bitchin'*fast*3D^{2000}. Unfortunately, we are saddened to report that the card is no longer available. In a steel-cage octagon match with pitfighter extraordinaire David "Tank" Abbott, the Bitchin'*fast*3D^{2000} lost 47MB of LMNOPRAM when it absorbed a vicious muay Thai-style knee kick to the mid-section. Abbott won the match, and Video Loca retired the card in shame.

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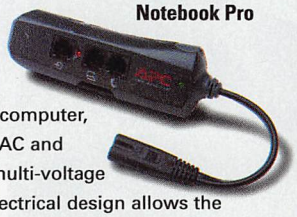

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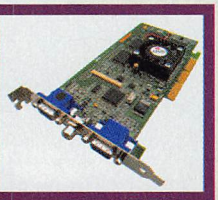
COMMPORT

I Demand a Kick-Ass Retraction!

After reading your review of the Matrox G400, I went out and bought one. Great card, but I don't think it deserves a Kick-Ass award. The award should be retracted in a future issue. Why? The OpenGL performance was based on an Alpha ICD, which is fine, well, and good. But Matrox just posted the new drivers with the new ICD (5.21), and the performance SUCKS! It is nowhere near the 73fps you reported in the benchmark—it's more like 60fps (on a 500MHz P-III).

It's obvious that by releasing slower, inferior drivers, Matrox could care less about its customers. My opinion is that the G400 should be appended to a 7 verdict. If nVidia and 3dfx can keep improving drivers, so can Matrox.

—Bruce Fenech



"My opinion is that the G400 should be appended to a 7 verdict. If nVidia and 3dfx can keep improving drivers, so can Matrox"

Departments Editor Sean Downey replies: Bruce, does the Millennium G400 MAX work as advertised? Does it kick out the most beautiful texels to ever tickle your eyeballs? Does it power two monitors at once? Have you seen environment-mapped bump-mapping in action? Does it kick ass in both Direct3D and OpenGL games? If it doesn't, then by all means take it back to the store and wait around for the videocard of your dreams to enter your life.

I stand behind my Millennium G400 MAX verdict, and I won't be rescinding the Kick Ass award. The Millennium G400 MAX isn't perfect; that's why I gave it a 9/Kick Ass instead of a 10. But I do think it's the most innovative card to enter our lab this year. I lowered the score by one point because I didn't think the card's OpenGL performance was where it should be. But since its release, Matrox's OpenGL ICD has improved at a good clip. I don't think it's as optimized as nVidia's ICD, but it's a hell of a lot better than 3dfx's.

I re-ran our *Quake II* timedemo (at 1024x768) with the latest 5.21 ICD and the card hit 70fps, just 0.7fps shy of the score I reported in the review using the Alpha version. *Maximum PC* can't account for your lower score; it might be time for some troubleshooting at the Fenech residence.

The Truth About CPUs and 3D Chipsets

If graphics chips such as 3dfx's Voodoo³ and nVidia's TNT2 are made in a 0.35- or .25-micron process, how come the core speed of the chips can't hit as high a MHz mark as CPUs do at 0.35 and 0.25?

—Kevin Wong

Fast Forward columnist Tom Halfhill replies: There are several factors besides the fabrication process that determine a chip's maximum clock rate. No type of processor (including a graphics processor) can run any faster than the slowest part of its logic circuitry, or its longest wire. If the processor has very complex instructions, the logic circuitry performing those instructions may limit how fast the clock can run. If it has long wires connecting circuits, the time it takes for an electrical signal to travel the length of that wire determines how fast the clock can run.

You may think electrical speed isn't a factor since electricity travels at nearly the speed of light and a chip is small. But the wires on a chip follow complex paths, and those little distances add up, especially at high clock speeds. At 500MHz, the time between each clock tick is two nanoseconds (two billionths of a second).

It's also cheaper to make slower chips. Chips are manufactured in batches by etching dozens or hundreds of die on a circular wafer of silicon. Due to manufacturing variables, the die on any given wafer will run at a range of clock speeds. By specifying a lower clock speed within that range, the manufacturer gets a higher yield of good die per wafer. If a speed at the upper end of the range is verified, most of the die will fail the verification tests and have to be discarded. That's very expensive, but you, the customer, ultimately pays in the form of higher prices for die that pass the tests.

BEFORE

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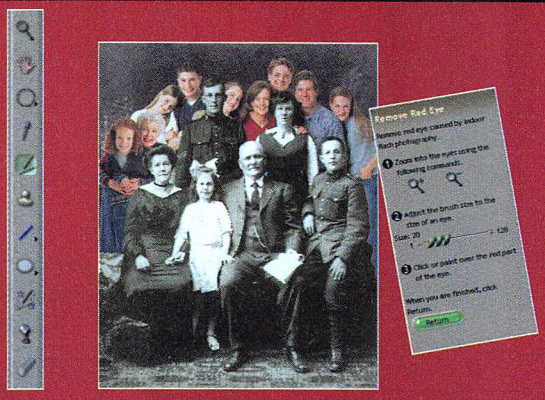

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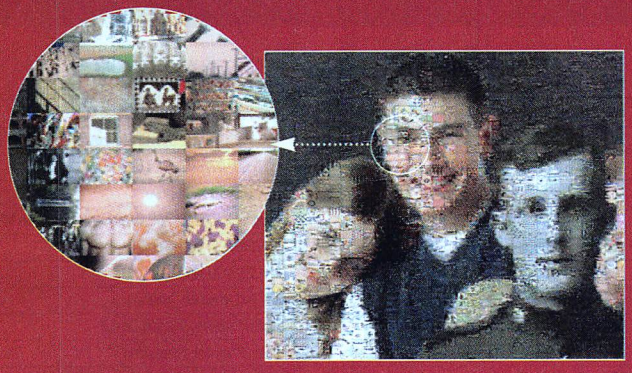

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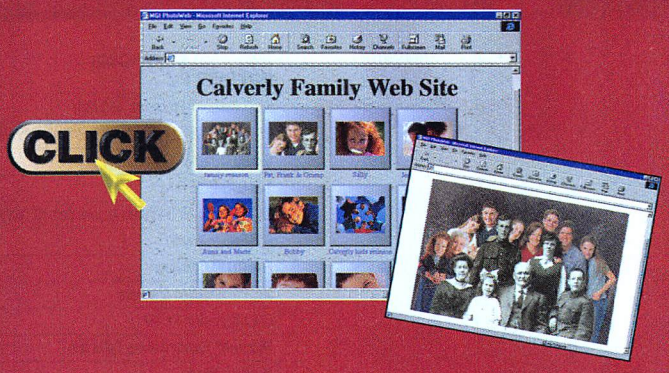

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60 Awards

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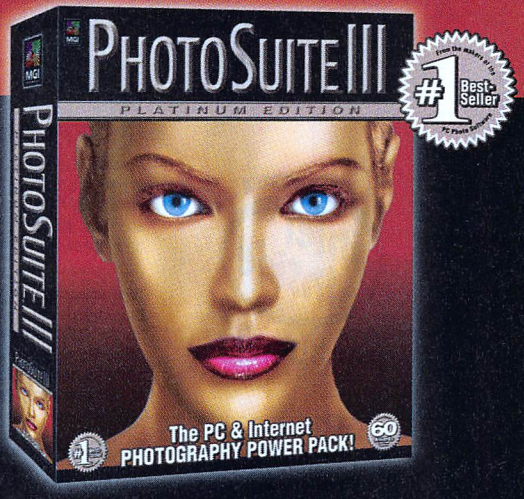

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	2X AGP w/64-bit Hardware Accelerated 3D Graphics	2X AGP w/64-bit Hardware Accelerated 3D Graphics	Voodoo 3 1000 2X AGP Graphics Card with 16 MB
	ESS Solo PCI Audio	ESS Solo PCI Audio	ESS Solo PCI Audio
	56K ITU V.90 Modem[3]	56K ITU V.90 Modem[3]	56K ITU V.90 Modem[3]
	JBL Pro Amplified Speakers	JBL Pro Amplified Speakers	JBL Pro Amplified Speakers
	Creativity Action Center	Creativity Action Center	Digital Creativity Imaging Center[6]
	Microsoft® Featured Home Collection	Microsoft Featured Home Collection	Home Phoneline Networking[8]
	Microsoft Word	Microsoft Word	Microsoft Featured Home Collection & MS® Word
	Microsoft Windows®98	Microsoft Windows98	Microsoft Windows98
	Compaq CV515 15" Monitor (13.8" VIA)	Compaq CV715 17" Monitor (16.0" VIA)	Compaq CV715 17" Monitor (16.0" VIA)
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Voodoo 3 1000 2X AGP Graphics Card with 16 MB	Creative Labs 3D Blaster 32 MB TNT-2 Ultra Accelerator
Sound Blaster™ Live! PCI Audio	Sound Blaster Live! PCI Audio
56K ITU V.90 Modem[3]	6.0Mb Max Digital Modem[4]
Klipsch v.2-400 Watt Speaker System	JBL Pro Amplified Speakers
Digital Creativity Imaging Center[6]	Digital Creativity Imaging Center[6]
Microsoft Office 2000 SBE®	Microsoft Office 2000 SBE
Microsoft Windows98	Microsoft Word
Compaq CV715 17" Monitor (16.0" VIA)	Microsoft Windows98
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	24X Max CD-ROM Drive[2]	24X Max CD-ROM Drive[2]
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	56K ITU V.90 Modem (PCI)[3]	56K ITU V.90 Modem (PCI)[3]
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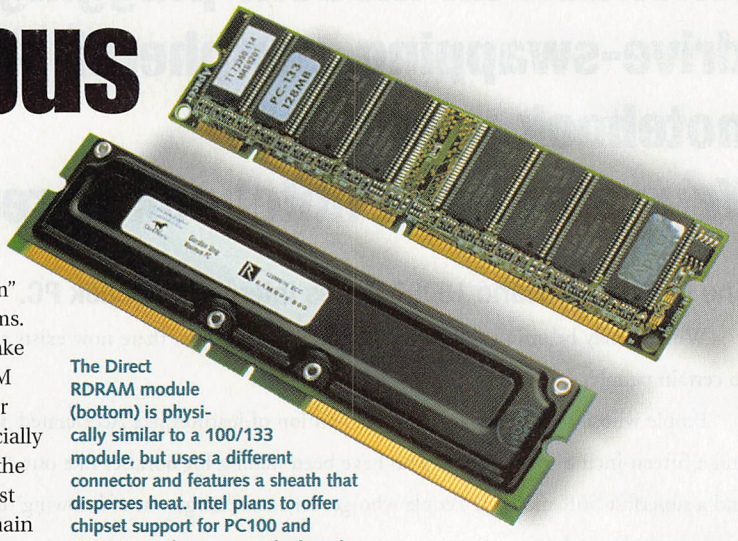
Direct Rambus

Your new memory standard



The Direct RDRAM module (bottom) is physically similar to a 100/133 module, but uses a different connector and features a sheath that disperses heat. Intel plans to offer chipset support for PC100 and RDRAM on the same motherboard.

By the time you read this, Intel should already have introduced its Camino 820 chipset, which supports blazing-fast Rambus memory, a.k.a. Direct RDRAM, a.k.a. Direct Rambus Dynamic Random Access Memory, developed by Rambus Inc. By 2000, AMD should also support Direct RDRAM in its Athlon chipsets, thereby realizing the EV6 bus's full 200MHz potential. Here's an in-depth introduction to the memory standard that's poised to replace SDRAM.

Key Features

Direct RDRAM will double the peak memory bandwidth of PCs to 1.6GB/sec. The extra headroom will theoretically allow your system to perform multiple simultaneous operations that were previously out of the question. The highest grade of Direct RDRAM will run at 800MHz internally, an eightfold increase over today's SDRAM. Direct RDRAM actually runs on a 400MHz clock, but because it hits both the rising and falling edges of the clock, it performs like 800MHz memory.

Direct RDRAM isn't just SDRAM with a nitrous kit strapped on—it's an entirely new memory architecture that fosters "intelligent communication" among your PC's subsystems. Applications designed to take advantage of Direct RDRAM will be able to "prefetch," or gather data before it's "officially requested," thus reducing the waiting time your CPU must endure when it petitions main memory for number-crunching fodder. While PC100 SDRAM averages about 500MB/sec of its potential 800MB/sec bandwidth, single-channel Direct RDRAM approaches its 1.6GB/sec max with an average throughput of 1.5GB/sec.

Direct RDRAM also lowers voltage from the standard 3.3 volts to 2.5 volts. Internally, it actually lowers power consumption to just over half a volt, effectively decreasing heat and power requirements while reducing the spurious radio signals that PCs generate. Direct RDRAM modules also have onboard power management that turns off those sections not in use. Even niftier, onboard thermal sensors can downshift memory speeds if the module overheats.

Why You Need It

Almost any work that relies on multiple memory streams and fast access to memory should benefit from Direct RDRAM. If you're looking to play an intense online game of *Quake III* at the same time you're burning a CD-R, Direct RDRAM is the answer, proponents say; try that scenario with today's systems and you'll burn a coaster. Other memory-intensive transfers—such as those that take place between the hard drive, memory, and CPU while moving large files across a 100BaseT network—will also benefit from the increased bandwidth. Speech recognition and MPEG-2 encoding and decoding should also get a kick-start from Direct RDRAM's concurrent memory streaming.

Hardware Support

The only motherboard chipset that currently supports Direct RDRAM is the Intel 820, which tops out with a 133MHz system bus. Expect Intel's "Vancouver" mobo to be the first 820/Direct RDRAM board available. Future Direct RDRAM chipsets include the Intel 840 (a workstation/server chipset) and any silicon that AMD or its partners can fab in support of the Athlon.

Availability

Originally scheduled to hit the streets by mid-1999, Direct RDRAM's introduction has been drastically stalled. The blame has been laid on everyone from Intel to Rambus Inc. to memory manufacturers, but two factors have actually affected the rollout: the

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SPIN CYCLE

This month's top stories broken down ▶

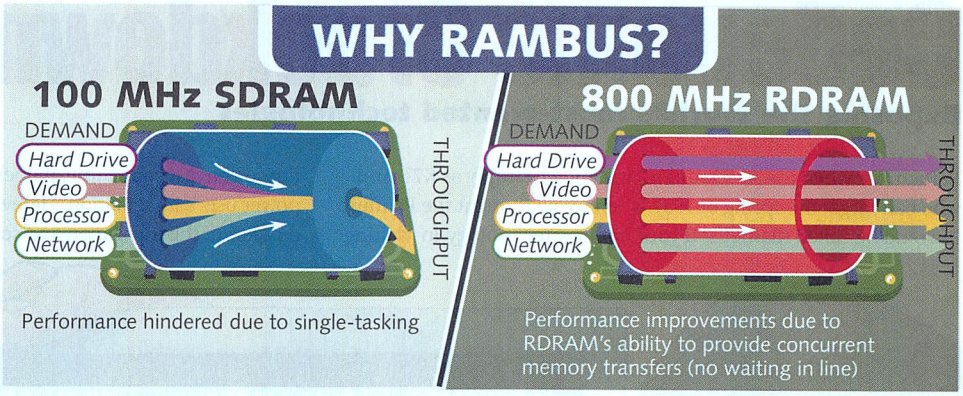
HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Microsoft, Compaq Drop NT Alpha support	Compaq and Microsoft have stopped developing Windows NT for the superfast Alpha CPU.	The companies said lack of interest caused them to rethink their plans.	"The bean counters win," says an AlphaNT source.	Despite all its warts, the Alpha was a processor that truly made NT seem like New Technology.
Future Power Tackles Dual Celeron	Small-fry PC maker Future Power is selling gaming and business machines equipped with dual Celerons.	Future is ignoring Intel's wishes by selling the uniprocessor Celeron in dual rigs using Abit's BP-6 motherboard.	"Our Dual Millennium models are as powerful as a system with a P-III processor, at a lower cost," said Future Power's Bill Voecks.	Get 'em while they're hot. Intel is expected to introduce new circuitry that will make it almost impossible to run dual Celerons.

memory manufacturers' ability to fab Direct RDRAM en masse at a new 0.18-micron process, and their ability to certify the memory using existing memory-testing equipment. Because traditional testing equipment just can't keep pace with Direct RDRAM's high bandwidth, memory companies were forced to rebuild their testing infrastructures—a process that requires time and money.

If everything works as planned, you should see Direct RDRAM in big-name systems by this fall. However, retail availability of Rambus Inline Memory Modules (RIMMs) will be sparse as system builders suck up the supply, and electronics stores wait for prices to level out. Almost every large memory manufacturer—from Samsung to Hitachi to Crucial Technologies—has jumped on the Direct RDRAM bandwagon.

Pricing

Anticipate high RIMM prices. The only manufacturer fully ramped up for Direct RDRAM is Samsung, giving the Korean company a seller's market. Samsung has sustained losses for years in the "RAM Wars," so expect prices to remain high in the early going. Optimistic OEMs estimate the price of a single 128MB RIMM will cost in the $200 to $300 range (the street price of a 128MB PC100 DIMM is currently about $200).



The Rambus Advantage Direct RDRAM promises to unclot your system faster than Super Drain-O.

Direct Competitors

Intel wants you to use either the same 100MHz SDRAM you always have, or crazy-fast Direct RDRAM on a 133MHz bus. Chipset giant VIA Technologies is pushing 133MHz SDRAM, hoping to squeeze more life from the 20th-century memory standard. Micron has already told us it will support this renegade go-between, but it remains to be seen whether anyone else (other than anti-Intel hobbyists) will hop aboard the PC133 train.

Some PC makers might also opt for Virtual Channel 133. A subset of PC133, VC133 uses a small amount of superfast Static RAM to act as cache, or buffer, for the main SDRAM. AMD will investigate Double Data Rate SDRAM—which can transfer data on both edges of the clock cycle, yielding double the performance—for possible use in Athlon systems.

Pitfalls

PC133 promoters purport that the pricing difference between DIMMs and RIMMs will be much greater than $100. SDRAM proponents say Direct RDRAM will add as much as $700 to system prices, and that Direct RDRAM heats up and slows down during heavy workloads. But the harshest knock against Direct RDRAM is that it performs no better than PC133, and is actually slower than VC133.

The Direct RDRAM camp says these nagging complaints come from companies that lack the nads to make the jump to a higher level of performance. They claim that heat will be a problem only for those who haven't properly designed their cases, and that pricing will be slightly higher, but not by as much as the critics say.

—Gordon Ung

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The Truth

What's the truth about Direct RDRAM? The truth may be out there... but it's not here yet. After thoroughly comparing a Direct RDRAM system to VC133 and PC100 systems, we discovered the newfangled memory doesn't offer significant performance boosts for our battery of real-world Win98 applications. Today's server boxes and tomorrow's CPUs and applications might make better use of Direct RDRAM, but for now we're nonplussed. See page 102.

to the pertinent details.

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HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Lethal Weapon G4	Apple's new Macintosh has been declared a "weapon" under U.S. export laws.	The new PowerPC G4 is theoretically a weapon and cannot be exported to countries because of its computational power.	"The revolutionary G4 processor with its remarkable Velocity Engine is the first supercomputer on a chip," says Apple.	Why even call it a Mac anymore? The G4 has 2x AGP, IDE, and USB—all of which have been standard in PCs since 1997.
Gates Has Issues With Movie	Bill Gates had unkind words for *Pirates of Silicon Valley*, which claimed to portray the early days of Apple Computer and Microsoft.	Gates said the movie just "didn't get the facts right" about those nascent computing days.	"This business was fun and exciting and full of great people and it's been a great privilege to be part of it being created," Gates said.	Hollywood regularly bends facts to "enhance" storytelling and probably did so for *Pirates*.

Codename Crackdown

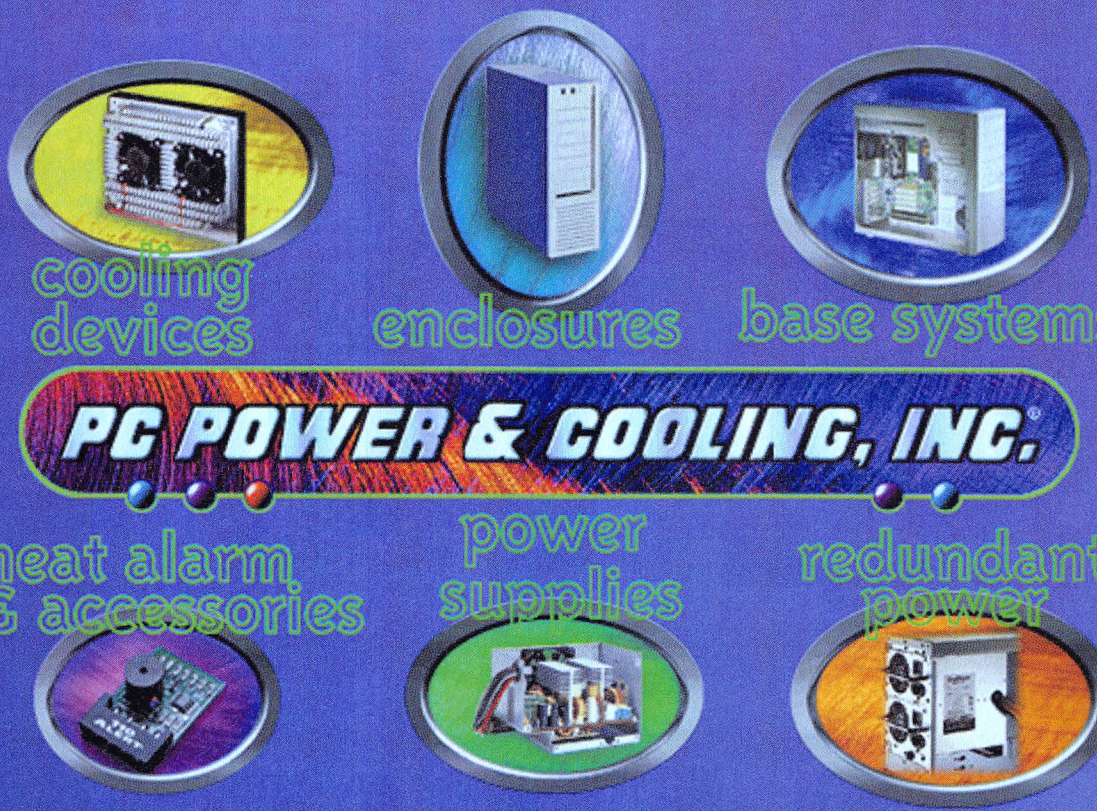
Exposing the world's most-wanted technologies

Remember when the AMD Athlon was known simply as K7? And who can forget the spring of 1997 when we all thought the Pentium II would be called Klamath? If your hot new technology-in-waiting doesn't have a codename, it doesn't stand a chance of capturing a power user's imagination. Herewith, we offer our intelligence dossier on the top silicon and software projects in development.*

CODENAME	CLASS/PROFILE	INTELLIGENCE	THREAT ASSESSMENT
"CARMEL"	Chipset: Intel server chipset; now known as 840.	Features two Direct RDRAM channels for 3.2GB of bandwidth; runs Slot 1 and Slot 2 CPUs.	Medium. Adoption could be slowed by Direct RDRAM shortages/price gouging.
"CASCADES"	CPU: Intel successor to Xeon and the final member of the Slot 2 processor line.	Rumors say this .18-micron chip will have 256KB of on-die L2 cache and run in the 800MHz range; larger L2s are expected to follow.	Unknown. Cascades is so far out, we dare not theorize on Intel's plans for it.
"COPPERMINE"	CPU: Intel performance-desktop CPU; 0.18-micron Pentium III core with 256K of full-speed, on-die L2 cache.	Expected to debut this year at 700MHz on a 133MHz bus (care of the 820 chipset).	Medium. Coppermine will carry Intel's flag in 2000, but will it be craftier than Athlon?
"GEYSERVILLE"	CPU: Intel dual-speed mobile processor based on the P-III; 0.18-micron.	Runs full speed when plugged into a wall; slows down when on batteries (to conserve power).	Medium. Desktop-level clock speeds, yes, but can you consider a notebook CPU an offensive weapon?
"K8"	CPU: AMD processor with 64-bit core; successor to Athlon.	Intelligence data is almost nil—could K8 be renamed "Octathlon"?	High. Athlon is currently hitting Intel hard; K8 should be equally wily.
"MERCED"	CPU: Intel 64-bit über-CPU; also known as IA-64; will run in massive parallel configs for serious server/workstations.	This codename already has sub-codenames: "McKinley" will double Merced performance; "Madison" takes the core to 0.13-micron; "Deerfield" will be a consumer version.	High. Intel is relying on Merced to break away from the x86-architecture forever; it's really intended for next-gen OSes.
"NAPALM"	Graphics chip: A 3dfx follow-up to the Voodoo^3; includes 32-bit color support in games.	Napalm will support onboard geometry acceleration as well as several cinematic Hollywood effects.	High. 3dfx wants to return to technical dominance with Napalm warfare.
"NEPTUNE"	OS: Microsoft's consumer operating system for the 2000 timeframe.	Neptune will finally merge the NT kernel with a true consumer OS.	High. This could be the first consumer OS to offer multiprocessor support.
"NV10"	Graphics chip: Nvidia's successor to the TNT2; recently revealed as GeForce 256.	Includes onboard geometry acceleration, capable of crunching 50 GigaFLOPS.	Very High. Portends to be the most dangerous graphics chipset of the new frontier.
"TIMNA"	CPU: An Intel x86-based processor with almost all system functions integrated on-die.	Timna will tie graphics, sound, memory, and I/O into a single chip for use in set-top boxes.	Medium. It remains to be seen whether Intel can infiltrate this low-end guerrilla war zone.
"WILLAMETTE"	CPU: Intel 0.18-micron processor; aims to take desktop PCs past 1GHz in late 2000.	Like Foster, may herald the return of Intel performance CPUs to sockets; expect aggressive R&D effort for 2000 release schedule.	High. While Pentium III was really "Pentium II with 3DLater!," Willamette may be Intel's desktop Athlon-killer.

* Due to the vicissitudes of disinformation and counterintelligence, we cannot testify to the reliability of these reports. Expect the aliases to change by the time these projects see fruition; specific deployment dates unknown.

ILLUSTRATION BY SCOTT PECK



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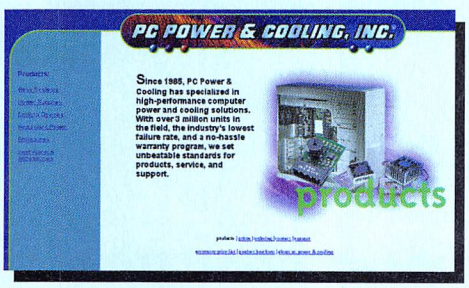

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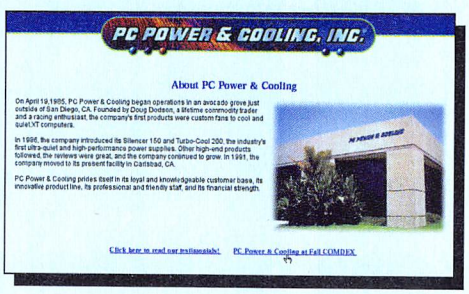

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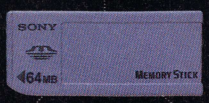

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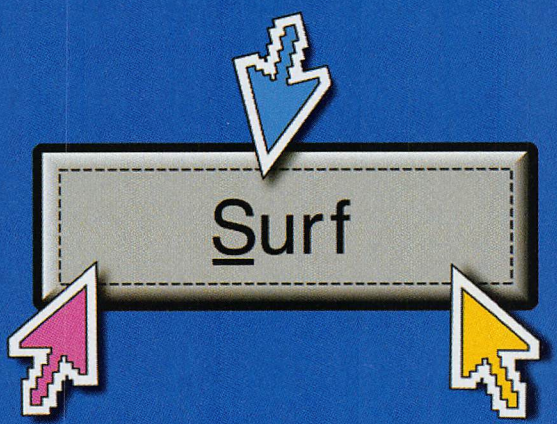

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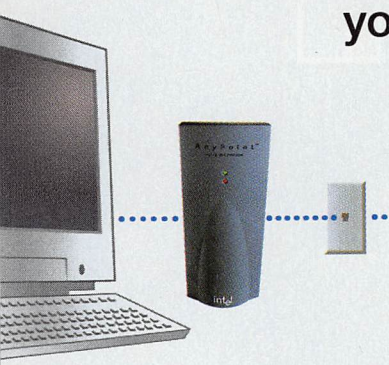

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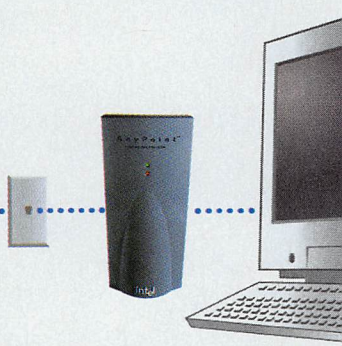

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Maximum PC takes a bite out of bad service and gear

WATCH DOG

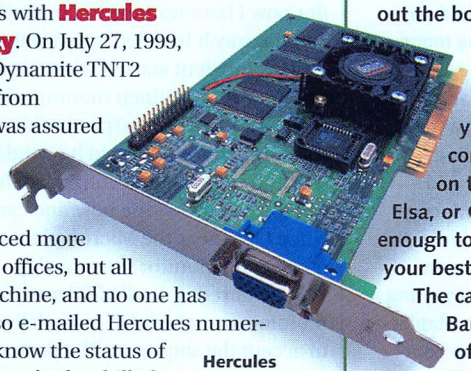
This month:

- Hercules Bows Out
- Rebate Chair Game
- NewCom Bombs

CHECK IT OUT online
www.maximumpcmag.com
Readers share woes in the Dog Pound.

HERCULES LOSES STRENGTH

DEAR DOG I am writing because I have no other recourse. My problem lies with **Hercules Computer Technology**. On July 27, 1999, I preordered a Hercules Dynamite TNT2 Ultra with DVD for $249 from Hercules' online store. I was assured that I'd receive an e-mail when the board was shipped; I never heard from Hercules. I have placed more than 20 calls to Hercules' offices, but all I've ever talked to is a machine, and no one has called me back. I have also e-mailed Hercules numerous times. I'd just like to know the status of my order and whether Hercules has billed me or cancelled my order.



Hercules Dynamite TNT2 Ultra

—Tim Sutton

THE DOG RESPONDS There's nothing but bad news for Tim and the dozen other readers who wrote the Dog about Hercules. Hercules Computer Technology abruptly shut down and filed for bankruptcy on August 24.

For those who don't know, Hercules was a pioneer in the computer graphics industry and helped push the original IBM PC to new heights in the early 1980s with the Hercules Graphics Adapter. Hercules' latest offering, the Dynamite TNT2 Ultra, was known as the fastest gaming card available. Given that Maximum PC awarded the Dynamite TNT2 Ultra a 9/Kick Ass and included it in the 1999 Extreme Machine, we were truly heartbroken to see Hercules fade away.

What are the details of Hercules' last days? At presstime, no one from the company could be reached for comment, but ex-employees gave the Dog a few nuggets of information. Rumors of embezzlement and mismanagement currently floating around the Internet are flat wrong, one former employee told the Dog. "We basically ran out of money toward the end," the ex-employee said. Apparently, employees of Hercules had been working for weeks without pay. There were rumors of a merger, but when it didn't come through, employees and management decided they could no longer work for free, and resigned.

Some fingers are pointing at the chairman of Hercules' board, Sakarian Van Suwannukul, with claims that he failed to fund the company with enough cash to continue operations. Suwannukul holds a majority of Hercules' stock and was apparently the force behind last year's nixed merger with Elsa.

Suwannukul could not be reached for comment, and his attorney, Irving Kornfield, refused to return repeated calls from the Dog.

But according to the former employee, "Suwannukul said he'd rather spend money on lawyers to take care of Hercules rather than pay the employees to carry on. It just got to the point where we didn't have the money to turn out the boards."

Most of the pre-orders Hercules was sitting on when it went under were simply never filled. If you ordered a Hercules card, check your credit card bills for any charges from the company. If none appear, don't sweat it and move on to another TNT2 vendor such as Creative Labs, Elsa, or Guillemot. If you're among those unlucky enough to have sent in a board for warranty replacement, your best recourse is to file a claim with the company. The case, number 99-46858-NC-7, is filed in the U.S. Bankruptcy Court of the Northern District of California, Oakland Division, P.O. Box 2070, Oakland, CA 94604-2070. To file, complete a B10 claim form, available from your local bankruptcy court or on the web at http://uscourts.gov/bankform/formb10new.pdf. Send two copies of the completed form to the court, along with a self-addressed, stamped envelope; you should receive proof of your claim.

"I have placed more than 20 calls to Hercules' offices, but all I've ever talked to is a machine, and no one has called me back."

What are your chances of collecting? Pretty poor. According to Hercules' bankruptcy filing, the company claimed it had between 200 and 999 creditors and between $1 and $10 million in debt but only $100,001 to $500,000 in assets. Among those owed cash are 3dfx, 3Dlabs, and Activision. But while the chances of seeing any cash from Hercules may be slim, most bankruptcy attorneys the Dog has spoken with say it's worth the investment of two postage stamps.

WHO HAS THE REBATE?

You see an ad in the Sunday newspaper advertising an item's price at $100 with a $50 rebate. You buy the item and send in for the rebate. Six months and dozens of phone calls and e-mails later, you still don't have your rebate.

Sound familiar? Detroit attorney Peter Macuga says he knows how to fight back. He's suing retail giants Best Buy,

Circuit City, Computer City, and Staples, on behalf of three consumers claiming that the stores pushed **NewCom** computer components on customers even though they knew the company wasn't fulfilling its rebates.

The Dog dished about Macuga's suit against NewCom in the August 1999 issue of Maximum PC. Of the 200,000 people who filed for rebates from NewCom, only 10,000 received them, Macuga says. Before NewCom paid those who were owed, the company slammed its doors shut.

Now, Macuga believes the stores that sold the merchandise should ante up to their customers, because they knew NewCom wasn't paying the rebates.

"Best Buy, Circuit City, Computer City, and Staples [made] promises that were clear, definite, and unequivocal, and were specifically made to induce Plaintiffs to purchase NewCom products," the suit says.

"It's rare to see a case filed against retailers for a manufacturer's problems."

Macuga claims that when the companies realized NewCom wasn't honoring rebates, they withheld money from NewCom in an effort to force payment of the rebates. Now that NewCom has shut down, Macuga believes that the companies should pay customers who are owed rebates with the money they withheld from NewCom.

How much is being held? Best Buy has some $1.6 million that would have gone to NewCom, according to the suit. Circuit City is holding $900,000, Computer City has $415,000, and Staples holds a whopping $3.7 million. Macuga says that since NewCom has bolted its doors, the stores should disburse the cash to consumers.

The stores disagree. The attorney representing Staples, Thomas O'Connor, says that at one point, Staples actually paid the rebates directly to consumers who complained about NewCom.

"Staples wanted to maintain good relationships with their customers," O'Connor told The Dog. "Staples was the good guy in this." As to the allegations that Staples withheld money from NewCom and continued to advertise rebates after the company knew NewCom was defaulting on rebates? O'Connor says neither allegation will be "proven to be accurate."

It's rare to see a case filed against retailers for a manufacturer's problems, according to Matt Gold, a staff attorney for the Federal Trade Commission, the agency charged with enforcing many consumer-protection laws at the federal level. Gold says that in general, retailers should have more culpability beyond just repeating the rebate amount in ads.

"We bring cases all the time against companies that have made deceptive claims, and very often those claims appear in ads for a retailer," Gold says. "In most of those cases, we are not pursuing the retailer."

THE COST OF TWO BITS

Todd Borenstein purchased his **Umax Astra 1220** flatbed scanner with the understanding that it delivered "36-bit" scanning. To achieve true 36-bit color, or billions of colors, a 12-bit analog-to-digital (AD) converter is needed; unfortunately for Borenstein, Umax used a 10-bit AD converter and a software trick to create extra colors. Umax competitor Visioneer cried foul, and in December 1998, successfully sued to stop Umax from labeling it as 36-bit. Now, Borenstein and San Francisco attorney Joseph Tabacco have filed a class-action suit on behalf of consumers who purchased the 34-bit scanners but thought they were buying 36-bit scanners. You don't need to "sign up" to be included in a class action suit, but if you feel burned by Umax, the suit should be on your radar. Watch this space for updates.

All this bankruptcy and legal upheaval has even the Dog feeling down in the mouth. Let's end on a high note from B. Koho of Nampa, Idaho.

A BONE FOR MICRON

I know the Dog is primarily on the lookout for companies that have done wrong, and that's how this incident started. But now I have nothing but praise for **Micron Electronics** and the way it handled my warranty claim.

This incident started when my one-and-a-half-year-old Micron 700LX 17-inch monitor died on me. Since Micron offers a three-year warranty with its monitors, I contacted the company. A tech said he would ship a new monitor to me, and that I should ship my defunct monitor back to Micron in the box the new one came in. He also said that since I live near the Micron plant and showroom, I should receive the monitor the next day.

The next day, I called Micron to find out when my monitor was scheduled to be delivered, so I could be home to accept the shipment. The person I spoke with this time told me that the original tech-support specialist had made an error on the warranty claim, and that the claim could not be processed until he came back on duty and fixed the error.

The tech didn't come back on until later that night, and did not get the claim fixed in time, so my new monitor was delayed two more days. Five days after the experience started, UPS delivered my monitor: a new Micron 900LX 19-incher. Since I was returning a 17-inch monitor, I figured Micron had messed up again. I called and told them that they had sent me the 19-inch monitor in error. When I spoke with tech support, they told me that the numbers on the invoice were correct and I'd been sent the correct monitor. They said that due to the mishap with the claim, and because they were out of 17-inch monitors, they opted to send me the 19-inch monitor rather than make me wait. Well, blow me down!

Micron is not only *not* in my Doghouse, but they can come over for dinner and spend the night anytime! Kudos to Micron for truly caring about its customers and putting forth the effort to keep them. I can guarantee they have a repeat buyer in me!

—B. Koho

Got a bone to pick with a vendor? Been spiked by a fly-by-night operation? Sic the Dog on them by writing **watchdog@maximumpc.com**. The dog promises to get to as many as possible, but only has four paws to work with.

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– **Fred Lugano**, weatherization.com, Vermont

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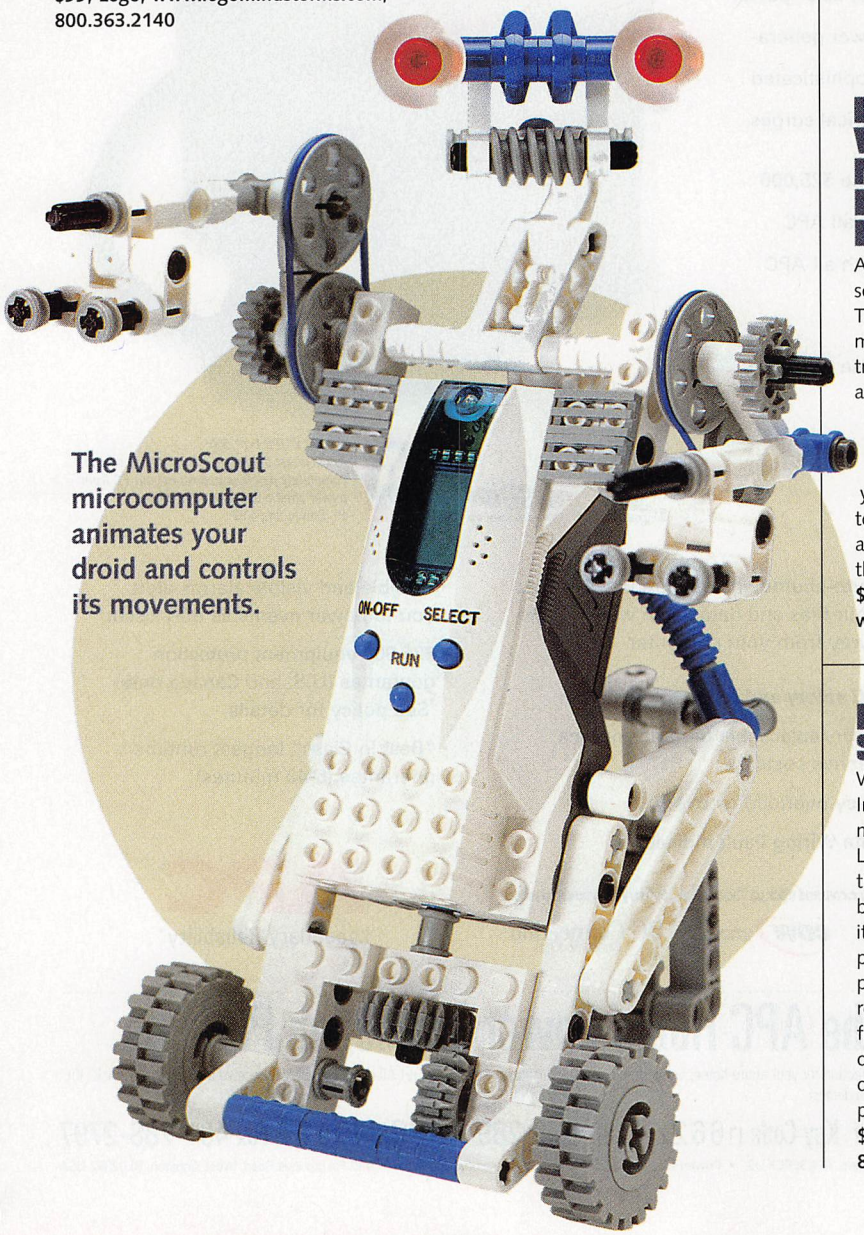
$99; Lego; www.legomindstorms.com; 800.363.2140



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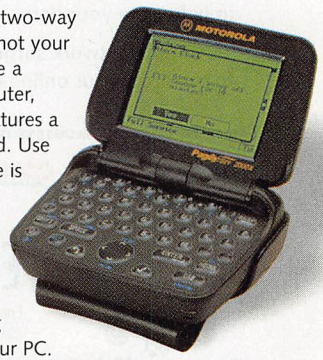

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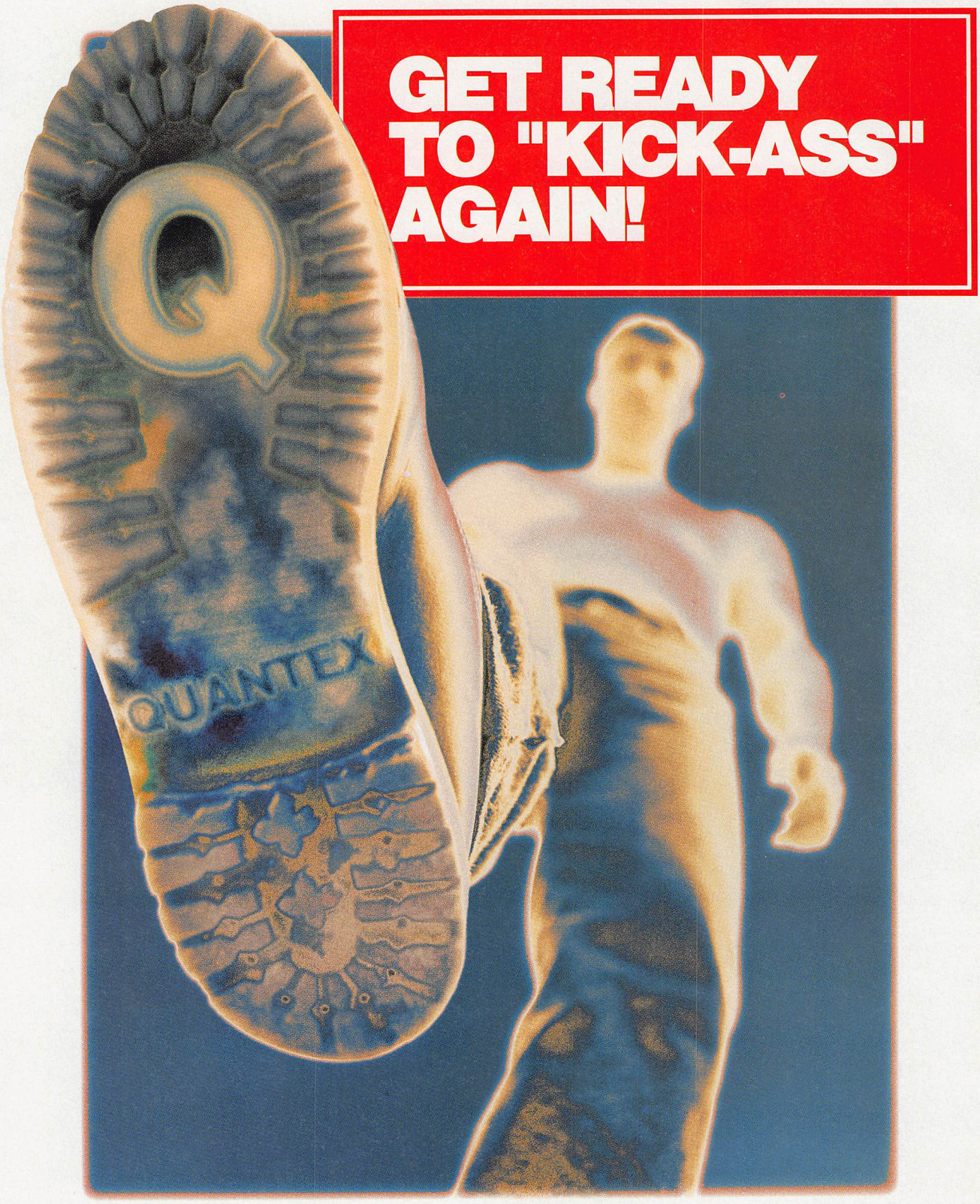

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▶ TOMORROW'S TECHNOLOGIES EXPLAINED

FAST FORWARD

So, you think you're king of the world with your new Pentium III and nVidia TNT2 card? Get ready to eat dust, slowpoke. You're about to get blown away by a lowly videogame console that runny-nosed little kids will bring home from Toys R Us.

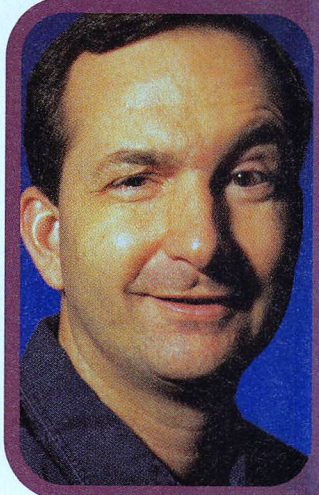
Incredible as it may seem, Sony is prepping a next-gen PlayStation that's so powerful at rendering 3D graphics, it'll smoke any PC on the market for at least a year after it debuts in mid-2000. It's more powerful than Sega's Dreamcast, which is just now appearing outside Japan. It's more powerful than the SGI workstations that Pixar used to make the film *Toy Story*. It's more powerful than the CAD workstations that Boeing used to design the 777 jet airliner.

I realize this is hard to believe. How can a game machine scorch tricked-out PCs that costs up to 10 times as much—not to mention high-end workstations that cost up to 100 times as much? The quick answer is that Sony's PlayStation 2 is highly optimized for one thing: 3D graphics. The single-minded pursuit of a single goal can yield remarkable results. Game machines don't have to do anything but play games, so they don't have to make as many compromises as other kinds of computers.

PlayStation 2 has two more advantages: It needs only to crank out enough screen resolution to look good on a crappy output device (a TV set), and it doesn't necessarily have to make money.

What? It doesn't have to make money? Nope. Companies like Sony earn profits by selling the game CDs themselves, and the best way to sell games is to pump millions of game machines into the market as quickly as possible. If the PlayStation 2 retails for about $300, Sony will almost certainly lose money on every unit sold, because the custom-designed chips that power this monster will cost about $260 to manufacture, according to expert estimates.

rocket in a socket. Although it runs at only 300 MHz, it's optimized for 3D graphics, so it executes floating-point operations three times faster than a 500MHz Pentium III with SSE and 15 times faster than a 400MHz Pentium II or Celeron without SSE. Together, the EE and GS chips can draw 75 million polygons per second and fill 2.4 billion pixels per second. And yes, those are Gouraud-shaded, z-buffered, alpha-blended polygons, not just wire frames. The console is almost four times faster than nVidia's RIVA TNT2 chip. It's almost seven times faster than 3dfx's Voodoo^3.



Oh, and did I mention that the PlayStation 2 also has 32 MB of Rambus DRDRAM for main memory, a DVD-ROM drive, a modem, a USB port, an IEEE-1394 FireWire port, and Dolby Digital AC-3 and DTS sound? Its main game is 3D graphics, but it'll play movies, hook up to peripherals, and run any other software that developers write for it, too.

And it's not vaporware. I've seen a live demo. The 3D graphics are awesome. The animation is close to *Toy Story* quality—except it's generated in realtime, not overnight on a farm of workstations.

TOM HALFHILL
was senior editor at Byte magazine and is regarded as one of the most knowledgeable experts on processor technology in the industry. Contact him at **thalfhill@maximumpc.com.**

Console Comeback

HOW PLAYSTATION 2 WILL SHAME YOUR PC'S FEEBLE 3D GRAPHICS

Add the cost of other miscellaneous components, the materials bill exceeds the retail price, leaving no room for profit. Sony would probably have to charge $400 or even $500 just to break even.

Fascinating financial facts aside, unless you're a Sony stockholder, the most interesting thing about the PlayStation 2 is what's inside. It has three processors: a CPU called the Emotion Engine (EE), which Sony codesigned with Toshiba; a graphics coprocessor called the Graphics Synthesizer (GS), designed by ArtX; and a MIPS 4000-compatible chip that handles input/output functions and provides backward compatibility with existing PlayStation games.

PlayStation 2 needs only to crank out enough screen resolution to look good on a crappy output device, and it doesn't necessarily have to make money.

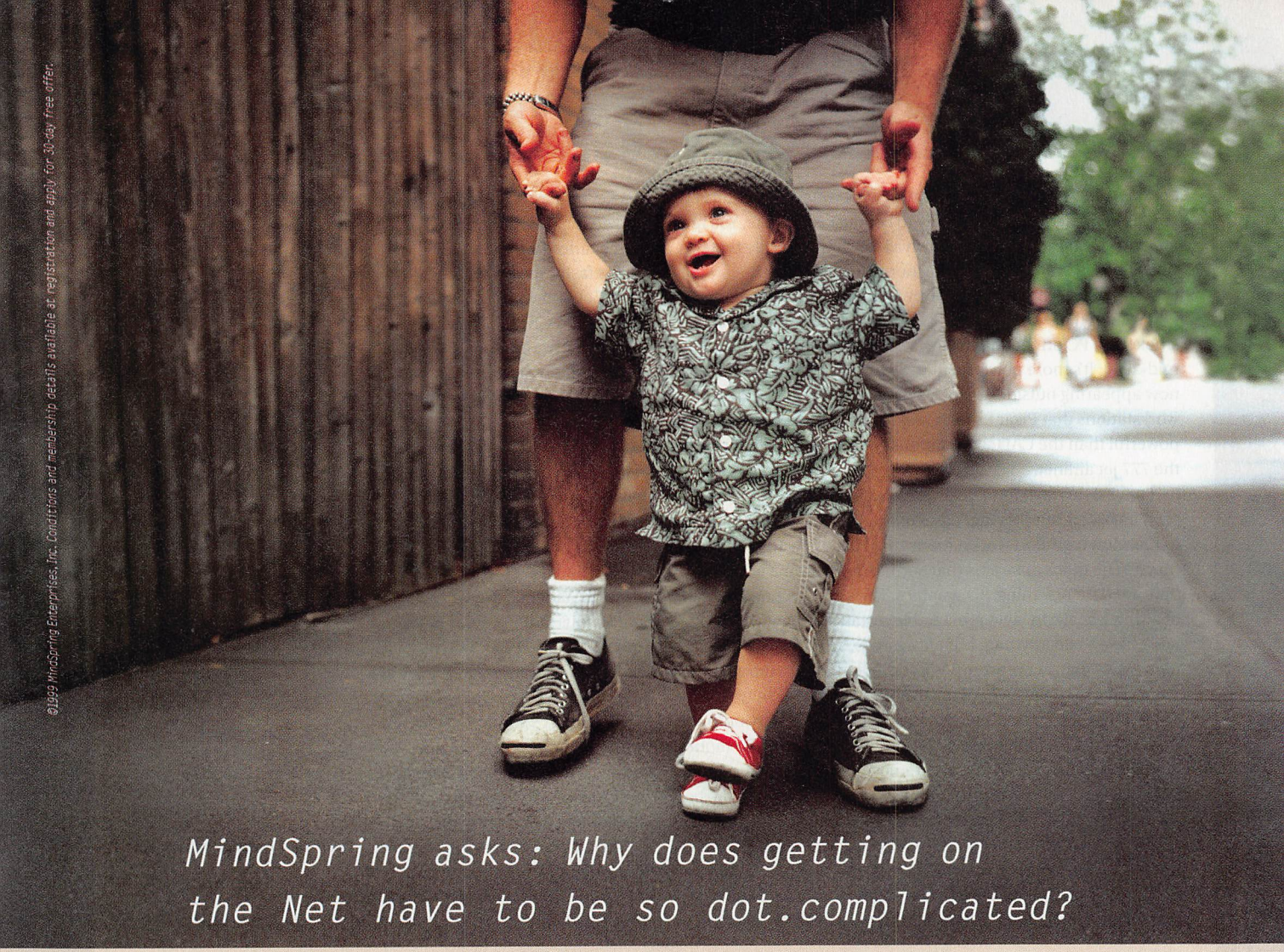
Let's put this in perspective. The input/output chip, by far the weakest processor in the machine, is almost identical to the main CPUs in SGI workstations and servers. The EE chip is a true

My boss at this magazine thinks consoles are poor substitutes for PCs. I'm not a game player, so I prefer PCs, too. But when the PlayStation 2 comes out, I bet we'll pull down the shades, grab a joystick, and secretly take this machine for a joyride. ✹

Bits & Bytes

▶ I've always had trouble making my Java applets work with *Internet Explorer*, though they work fine in Netscape *Navigator*. After Sun took Microsoft to court, a judge ruled that Microsoft had to ship a compatible version of Java with *IE*. Suddenly, my applets started working—even though I hadn't changed a single line of code. Now an appeals judge has temporarily vacated the lower court's ruling. Will Microsoft put the bugs back in? You tell me—if you've installed the latest rev of *IE5*, go to **http://www.hooked.net/~halfhill/inflation.html** and see if it works.

▶ AMD's Athlon includes 24 new instructions for faster multimedia performance. They supplement the existing 3DNow! instructions, and they're virtually identical to the 24 multimedia instructions in Intel's Pentium III with Streaming SIMD Extensions (SSE). Multimedia apps that use SSE can easily use the new Athlon instructions, too. The Athlon still isn't compatible with all SSE instructions, but this is an important first step, and it covers the most important instructions for multimedia.



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NET SENSEI

Lick it? Stick it!

FIVE EASY STEPS TO ONLINE BILL PAYING

Rarely do I open my mailbox. Hey—all it spews is bills. My snail mail aversion wouldn't be so bad if it weren't for the fact that a money vacuum always seems to open the day *after* all the bills I was avoiding come due. The only bill I *always* pay on time is my student loan, because horror stories about missing a single payment have stricken fear-of-God level anxiety in me.

According to Tower Group, a Newton, MA–based market-research company, Americans waste an average of two hours each month organizing, reading, and writing checks for bills. But there is another way: online bill paying. My computer has more memory than I do to process my bills, has better math skills, and—best of all—can save me from licking that icky stamp. I embraced credit-report reformation, and so can you.

1. Getting Started First, you need some bills (you have that), access to some money (I can't help you here), and Internet access via a browser with 128-bit encryption support. Either *Internet Explorer 4.0+ or Navigator 4.6* will work just fine.

2. Choose A Payment Method You can visit your creditor's web site and set up automated debits from your checking account, or for centralized control of *all* your bills, sign up with your bank's online services. You can also try one of the many new virtual banks, which are backed by the FDIC like physical banks, and often carry the Better Business Bureau stamp of approval. Good ones to scope include Security First Network Bank (**www.sfnb.com**) and CompuBank (**www.compubank.com**).

3. Sign Up Some banks do it online and some do it by snail mail, but it's all good—they just want your name, address, and basic info. Once you've sent your application and initial money and received your password, log in and get ready to save your tongue!

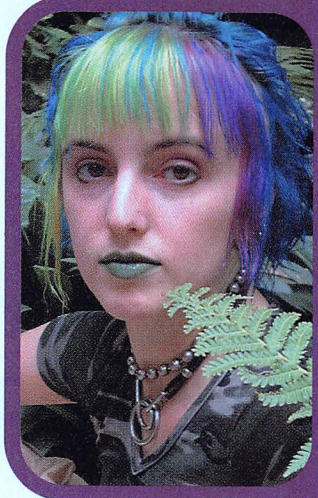
4. Set Up To set up your payees—that is, the creditors who will be receiving your money—find the Payees section in the site's navigation menu and enter the appropriate information: name, address, phone number, and account number where applicable. Good sites already have a pop-up list of common payees to select from. Enter the amount of money you want to send to this payee.

My computer has more memory than I do to process my bills, has better math skills, and—best of all—can save me from licking that icky stamp.

5. Set Your Schedule Next, decide when to send money. You can set up one-time-only or recurring bill payments. Most payments can be transferred to your payee electronically through the Automated Clearing House (ACH)—a standard used by physical banks. If your creditor can't accept an electronic transfer, your bank will send a paper check via snail mail. The creditor generally doesn't care what form the payment is in, as long as your money gets there.

Another Cool Feature

When you first log on at FirstUnion (**www.firstunion.com**), you might receive an e-bill from a payee—that's right, an electronic bill sent right to your account. Your bills can be forwarded to your e-mail address or automatically paid as they come in, so you don't even have to open them. Specify a maximum payment amount, so a surprise $500 phone bill doesn't wipe out your balance. E-billing isn't used by many creditors yet, but they're definitely kicking tires—and it's your key to <monster truck voice>total automation </monster truck voice>!



SHERRY MONARKO has used the Internet for everything from ordering pizza to getting married. She is currently the Chief Designer for Future Networks. Contact her at **smonarko@maximumpc.com.** .

Is It Safe?

Not to sound paranoid, but how safe is the check you dropped in the mailbox? And your credit card? Each time it's swiped at a restaurant or a store, its binary information is encrypted, transmitted across phone lines, and descrambled by your bank, which then encrypts an authorization code that is descrambled by the vendor's computer. Guess what? Online encryption works the same way.

Tips!

Allow 10 business days for your first online payment to be processed. When you send money without a bill stub, the payee has to get its act together, and your e-check might not be processed until the bill is already past due. Set up subsequent bills to be sent five business days before—not on—the due date. Triple-check your account numbers. Since you won't be sending a bill stub or coupon, if one of those 22 digits is wrong, someone else's account will get credit.

Read the "fine" print. Many online services claim to be "free," but follow the asterisk and you'll find it's for a limited time, or only if you maintain a ridiculously high minimum balance. Most services cost $5.95 per month. If yours is higher, shop around.

Make my check payable to... just kidding.

Bits & Bytes

Free Utilities I'd Gladly Pay For:

- **Ad-Banner Blocker** Seeks out the Img tags <height="468" width="60"> and prevents that graphic from ever loading.
- **Tripod Empathizer** For every time I get an annoying pop-up window, one appears on the offending webmaster's screen as well.
- **Wag the Lag** Sends a bogus lag message or ping number to a game server when you royally screw up, so you can say, "Hey! It wasn't me! It was lag!"

Don't worry, at NVIDIA, amazingly fast, cutting-edge graphics processors are all we do. The results are ultra-smooth frame rates and incredibly vivid colors that allow you to see and play 3D/2D games exactly the way game makers intended. Not to mention an Internet experience that comes to life. If you demand this kind of performance out of your games and the Internet, then demand your next PC or graphics accelerator comes loaded with a NVIDIA chip. There's no reason to settle for anything less. Graphics to the nth degree.

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▶ THE SCOOP FROM A MAJOR PLAYER

GAME THEORY

Perhaps some of you think *Command & Conquer: Tiberian Sun* is everything it should have been and more. To you I say, sincerely and respectfully, are you nuts?! Did we play the same game? The one mired in an eight-year-old design philosophy? The one with such remarkable features as units that saunter past enemies without firing and that fail to defend squadmates standing next to them? The one that might qualify as a glorified add-on disk, except precious little about it is glorified? That *Tiberian Sun*?

Tiberian Sun is the most intensely hyped, wildly anticipated disappointment since *Strike Commander*, but nothing I say will even begin to halt the *Tiberian Sun* juggernaut. It set records for pre-orders and first-day sales, and completely sold out at many stores; it might very well become the best-selling title of the year. Like an Adam Sandler movie, it is utterly critic-proof. (Not that it even needs to be, since most critics approach Westwood on bended knee, ignoring the fact that it hasn't published a good game since *Red Alert* or an innovative game since *Dune II*.) I had a similar reaction when *Command & Conquer* hit the shelves; we expected a revolutionary advance on *Dune II*, but instead we got a rehash of *Dune II*. Ditto *Red Alert*. Ditto again *Tiberian Sun*. Westwood is holding fast to a design that has evolved only minutely in the past eight years, while the rest of the RTS genre has graduated to complex orders, attack states, and a plethora of new twists.

Westwood's defense is simple: If it ain't broke, don't fix it. That's a good sound bite, but a poor excuse for ignoring innovations made in the realtime strategy genre that Westwood itself invented. It's as though the three years since *Red Alert* never happened. Hell, it's like the eight years since *Dune II* never happened—or never reached Las Vegas.

Hype Over Quality

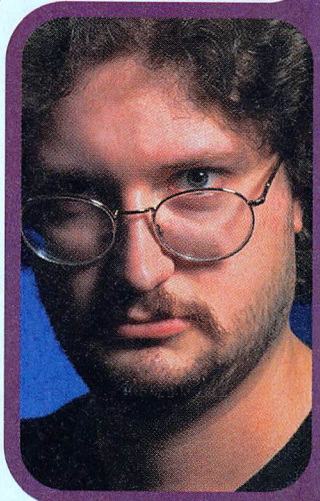
WESTWOOD'S LATEST GAME FALLS FLAT

I can understand Westwood's thinking. Blizzard, Cavedog, Ensemble, and other developers are building on concepts that Westwood pioneered. A radical, or even a minor change in design could wind up as the New Coke of computer games.

Tiberian Sun is the most intensely hyped, wildly anticipated disappointment since Strike Commander.

But overall, that logic doesn't wash. It assumes that since *Red Alert*, people have been sitting by their computers pining away for the new *Command & Conquer*, instead of playing *Total Annihilation, Dark Reign, Age of Empires, Seven Kingdoms, Starcraft*, and a dozen other evolutionary games. *Starcraft* is particularly notable because it does everything that *Tiberian Sun* fails to do. It hardly bowled people over at first; it looked too much like *Warcraft in Space* and eschewed the complex commands of *Total Annihilation*. But deeper play revealed subtle and ground-breaking detail, from innovative methods of play balancing, to tight mission scripting, to the truly diverse qualities in each of the three races. *Starcraft* didn't reinvent the wheel: It just gave that sucker all-weather radials.

Tiberian Sun, on the other hand, sports retreads. Take the mouse: In games from other developers, you select units with the right button and order them with the left button. Westwood has assigned the left button for selecting and ordering, and the right button for deselecting. This is not only a waste of the right mouse button, it's also blasted confusing for people who are accustomed to using this button for completely different purposes. Yes, it's a minor annoyance, but it highlights the way the game eschews advancements. A more serious problem is Westwood's utter failure to address the play-balance issue, best illustrated by the tank-rush tactic. *Starcraft* blunted this tactic with grouping limits and new defensive units. In *Tiberian Sun*, a couple of Subterranean APCs and a Montauk can end a game pretty fast, and Westwood hasn't placed limits on their use.



T. LIAM MCDONALD is a veteran of PC Gamer magazine and is much bigger than he looks in this picture, so keep that in mind before writing him any hate mail at **tmcdonald@maximumpc.com.**

It's a shame that a pioneering developer has become the computer-game equivalent of an oldies band: playin' 'em just like the fans heard 'em 30 years ago. I don't like kicking Westwood; the company created what I consider to be two of the best RPGs ever (the first two *Eye of the Beholder* games), not to mention the entire RTS genre that revitalized computer gaming. But unlike Blizzard, Westwood has utterly failed to advance. It no longer leads. It no longer even follows. It merely stagnates. ✹

Bits & Bytes

▶ *System Shock II:* Not nearly enough people are playing what is arguably the greatest first-person game in a long, long time. My suggestion if you're just starting out: Go Psi. Hackers just don't make interesting fighters, and the Marines simply give you a run-and-gun game like all the others. If you pump up the hack skill and develop beam weapons, your Psi can do anything.

▶ *Best Bug:* In *Starfleet Command*, ships in zig-zag formation often fly *through* each other, and missiles can pass through one ship and hit a target on the other side. Maybe that space-time-continuum thingy is to blame.

▶ *Best Use of Technology in the History of Human Endeavor: Totally Mad* includes seven CDs containing every issue of *MAD Magazine* ever. You get all the plastic records, animated fold-ins, searchable database, mini-movies, and a roll of toilet paper. What does this have to do with games? Well, um, Alfred's head is shaped like a basketball. Check out Rick Popko's review on page 114.

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BROA

OUR COMPLETE GUIDE TO RIDING THE BUCKING BRONCO OF HIGH-SPEED INTERNET ACCESS

Forget about faster CPUs, swifter memory buses, and speedier 3D acceleration. High-speed Internet access—a.k.a. "broadband"—is the most significant technological advancement to serve PC fanatics in 1999. As far as relative performance boosts go, the jump from 56Kbps to 10Mbps bandwidth is exponentially more impressive than the jump from Pentium to Pentium II, or Virge to Voodoo. In a nutshell, broadband will change your life—so get it immediately and by any means necessary. Indeed, the first time you download an 8MB MP3 file in less than 60 seconds, your eyes will light up, you'll crack a goofy smile, and you'll ask yourself how you ever coped with your old lame-ass V.90 modem.

This broadband buyer's guide covers the three major technologies currently rolling out nationwide: DSL, satellite, and cable. Each has its good and bad points, so it's time to become well-versed in which high-speed standard is best for you.

by Bryan Del Rizzo

DSL uses standard phone lines to offer high-speed access, but is hampered by slow rollouts, limited availability, and your relative proximity to your phone company's central office. Satellite technology sounds cool—who wouldn't want to send data packets through outer space?—but you'll still use your butt-slow traditional modem to send upstream data. Cable, meanwhile, is potentially faster and more readily available than DSL, but sharing a cable line with neighbors raises security issues we haven't considered since the demise of the telephone party line.

To help you pick the best broadband plan, we've dished up handy, bite-sized nuggets on each technology—how it works, how fast it runs, how much it costs, and how to get it. We even walk you through a typical installation, so you'll know what to expect after that broadband service truck pulls up in front of your house. If that weren't enough, we list cool tips, tricks, and caveats to consider when shopping for service. Finally, we reveal the speed of real-world file transfers—we benchmarked each technology with the same four content-transfer tests, then compared them to the speed of traditional 56K service.

What are you waiting for? Broadband will reinvent the way you use your PC. So get online—get really online—today.

ILLUSTRATION BY RON McPHERSON

BROADBAND

DSL "Digital Subscriber Line"

Don't get tripped up by the variety of Digital Subscriber Line (DSL) flavas out there. xDSL is a blanket term that refers to the entire family of Digital Subscriber Line technologies, which includes SDSL (symmetric), HDSL (high bit rate), and VDSL (very high speed). The only variants you need to consider for home use are ADSL (asymmetric) and G.Lite, both of which are suited for real-world consumer activity, such as web browsing and video-on-demand. G.Lite—a low-cost, lower-bandwidth version of ADSL—won't officially roll out until the end of 1999, so we focused on ADSL for this overview.

What It Is

DSL squeezes high-speed data bandwidth from the same ole phone lines you use when calling those psychic hotlines on Saturday night. The benefit of using standard phone lines—or "twisted copper pairs," as they're referred to by smarmy telecommunication groupies—is that you probably won't have to worry about rewiring your entire house in order to enjoy high-speed relief.

Using a process dubbed Digital Multi-Tone (DMT), DSL splits voice and computer data into two separate yet simultaneous streams. The voice stream remains at a frequency that's low enough for a human ear to hear (generally below 4kHz). The data stream, meanwhile, is compressed using a special encoder and injected into a higher frequency that doesn't impede regular voice calls. Best of all, DSL connections are "always on," so you don't have to worry about constantly dialing out to get online.

How Fast Is It?

ADSL, as its name suggests, is asymmetric, which means you'll get more bandwidth downstream than upstream. The International Telecommunications Union (ITU) has adopted a standard called T.992.2, which defines the maximum ADSL download speed at 8Mbps, and the maximum upload speed at 1Mbps. Traditional 56K modems download at roughly 53Kbps and upload at 33Kbps. So, in a side-by-side comparison, your ADSL connection could in theory be 150 times faster downstream and 30 times faster upstream. However, it's unlikely you'll achieve these rates, because how fast your connection runs is largely dependent on how close you are to your telephone company's nearest central office, affectionately known as the "CO."

To achieve the fastest possible speeds granted by the ADSL spec, your home must be located 9,000 to 12,000 feet (or 1.7 to 2.2 miles) from the CO. The farther away you get from the CO, the worse off you'll be. High-frequency signals attenuate (lose power) more quickly than low-frequency signals. So, even though voice signals may sound just fine if you're located far away from the CO, the data channel begins to lose its luster and signal strength the farther out you go.

According to the ADSL Forum, a consortium of companies promoting ADSL rollouts, a distance of less than 12,000 feet is ideal. If you live just 18,000 feet (3.4 miles) away, your maximum transfer speeds will drop to the vicinity of 1.5Mbps downstream and 384Kbps upstream. Think that's bad? If your house is 20,000 to 25,000 feet (3.8 to 4.7 miles) from the CO, you'll be lucky to get a measly 256Kbps of bandwidth in either direction. Anything farther than that and you may as well move to a new home.

How Much Does It Cost?

The typical monthly cost of ADSL is $50, ISP service included. But nothing is "typical" in the wacky world of broadband. ADSL providers—an amorphous collection of ISPs, Baby Bells, and middlemen who lease lines from the Baby Bells—structure their pricing plans around speed. The faster you want to surf, the more it's going to cost you.

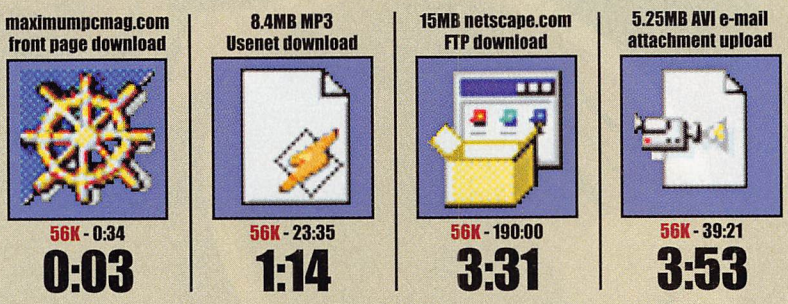
For example, in the San Francisco Bay Area, Pacific Bell charges $39 monthly for 1.5Mbps/128Kbps service. If you want the fastest plan (6Mbps/384Kbps), it'll cost you $129. Pacific Bell hard-fixes its upstream rates, but says downstream rates can vary depending on "customer line conditions." The fact is, with any DSL service plan, you might actually get much more bandwidth than you're paying for; the provider is simply promising a minimum bandwidth rate when it quotes speed numbers. For example, if you pay for 384Kbps downstream, you might actually get 1.5Mbps on any given day! Our own anecdotal tests have verified such bandwidth generosity.

Keep in mind that these Pacific Bell plans cover just your dedicated digital line; you'll still need to pay $10 for monthly ISP service. You'll also have to pay for installation and hardware. Typical installation charges can range from free to about $300; hardware can cost $100 to $400.

Most metropolitan areas are served by multiple DSL providers, so carefully compare

REAL-WORLD BENCHMARKING

Each of the four content-transfer tests was conducted between 8p.m. and 9p.m. on three successive weeknights. Fastest times achieved are reported in min:sec.



Our DSL tests were conducted with 1.5Mbps/384Kbps Concentric ADSL (subcontracted by Covad). Compared to the other broadband technologies, our DSL bandwidth varied very little from day to day, hour to hour. In fact, our MP3 test-file downloads from Concentric's news server never varied by more than 2 seconds, suggesting the link between provider and client remains rock-steady for ADSL users. The upstream AVI e-mail transfer tests consistently whupped cable's butt.

services; shop around to find a package that meets both your computing and financial needs. At a minimum, you'll want at least 384Kbps in both directions. Also, be diligent about multiyear agreements; you'll be penalized if you cancel early.

Where Can I Get It?

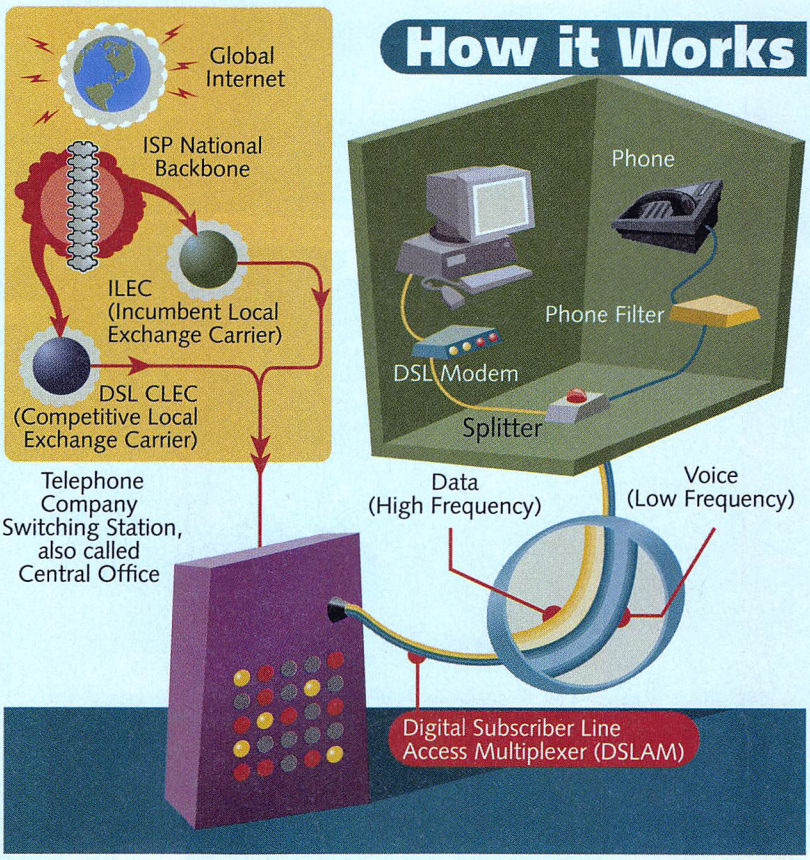
In theory, ADSL should be available wherever copper phone lines are located, and to anyone living sufficiently close to a CO that has a Digital Subscriber Line Access Multiplexer (DSLAM) installed. But sadly, this isn't the case.

To find out if you can get ADSL, call a provider to qualify your home as DSL-ready (see the resource list on page 56 for web sites that list providers). Qualification requires a visit from a service technician who'll inspect your line and run a signal to the CO in order to check line integrity. Unfortunately, most providers are backlogged, so this process can take up to several months.

Depending on the service you order, the age of your house, and how your house is wired, the technician might also attach a couple of splitters—one to the telephone box on the side of your house, and the other at the telco's CO. If a splitter is installed at your home, the pair of copper wires coming in from the telco will terminate on one side of the splitter, with two taps on the other. One tap is for your regular voice line; the other is for the DSL signal, which will then be attached to another copper pair running through your house.

Getspeed.com estimates that roughly 100,000 homes nationwide currently have DSL service (though states with no DSL service whatsoever include Alaska, Alabama, Arizona, Montana, New Mexico, Oklahoma, South Carolina, Tennessee, Vermont, and West Virginia). So, who *is* primed for DSL? Let's look at the numbers, as defined by Getspeed: There are roughly 20,000 COs in the United States. Roughly 65% of all U.S. households reside 12,000 to 18,000 feet from *any* CO. About 10% of these COs are currently DSL-ready (that is, "DSLAMed"). However—and this is important—roughly 40% of all U.S. households are currently being served by a DSLAMed CO. Hooray! The fact is, if you live in a major metropolitan area, you stand a good chance of living next to a DSLAMed CO. And if your local CO isn't already DSLAMed, it might soon be.

However—and this is just as important, but in a depressing, negative kind of way—only half the households currently being served by a DSLAMed CO can actually receive DSL service. Roadblocks include the vagaries of internal wiring and the location of specific residences.



Using compression technologies, DSL splits voice and data streams into low and high frequency signals, respectively, and sends 'em down the same copper pipe. This way, you can be on the phone while you're surfing the net.

The Hold-Up in Your Hood

When your local telephone company—referred to as the Incumbent Local Exchange Carrier (ILEC)—tells you that DSL service "isn't available in your area," all it's saying is that it hasn't yet installed a DSLAM in the CO closest to you.

But don't take no for an answer. Shop around and you might find an ISP that's working with a Competitive Local Exchange Carrier (CLEC), and has independently leased lines from the ILEC and installed the necessary DSLAM to get your neighborhood online. In other words, don't rely on Ma Bell. The odds are good that individual ISP/DSL middlemen can enable Ma Bell's

CONTINUED ON PAGE 56

DSL TIPS

▶ Make sure you know where your phone box is, and make sure it can be easily reached by the service technician.

▶ Before the technician arrives, make sure you know exactly what hardware, if any, you'll need to buy. Who knows, the NIC may be on you.

▶ If you're a hardcore PC user who wants to share bandwidth across multiple PCs or a home LAN, look for a combined DSL/router product and request multiple IP addresses from your ISP.

▶ If you use a UPS backup on your PC, plug your modem into the same UPS, and you'll still have Internet access when the lights go out in Georgia.

▶ To convert feet to miles, multiply the feet by 0.00018939359.

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SATELLITE

Hughes Network Systems' DirecPC is the only consumer-level, satellite-based, high-speed Internet service available today. A satellite that's in orbit above the Earth broadcasts data downstream to your PC. In the other direction, your PC's traditional modem transmits all your upstream data. DirecPC doesn't suffer any severe availability issues. Unless you're living in an underground bomb shelter doing the horizontal huckabuck with Brendan Fraser, you should be able to get this service.

What It Is

DirecPC transmits downstream data through a game of satellite/receiver hopscotch. All upstream data—everything from puny 1K file requests to gargantuan 10MB FTP uploads—is sent through a regular analog telephone line and computer modem. So, not only will you have to install a satellite dish in your backyard or on the roof and wire it up to your PC, you'll also need a phone line to browse the web. Your upstream bandwidth, which is fundamentally limited by the speed of your modem, is DirecPC's Achilles heel.

DirecDuo, a package deal from Hughes, combines DirecPC service with DirecTV, giving you access to hundreds of premium channels. The supplied dish includes two coaxial cable outputs; one feed goes to your PC, while the other goes to a receiver hooked up to your TV. Each line connects to its own orbiting satellite—one for communications, the other for television—each of which is finely tuned to guarantee either data integrity or picture-perfect reception.

How Fast Is It?

The upstream channel is limited to the speed of your modem, which, thanks to the Shannon Limit, maxes out at around 33Kbps. Downstream bandwidth is much faster—up to 400Kbps—which earns DirecPC the distinction of having the most lopsided throughput ratio of the three major broadband technologies. Nonetheless, DirecPC still outperforms a regular 56K modem, at least in downloading, by 8 to 1.

How Much Does It Cost?

Because satellite-driven broadband has only one major player, shopping for pricing plans is a cinch. Just visit **www.direcpc.com** for the latest deals. At press time, service plans were broken down into three tiers. The Executive Surfer plan gives you 25 hours of online time for $20 monthly (not including ISP service). Each additional hour is billed at 99 cents. Or, if you use DirecPC as your ISP, you'll pay $30 monthly for 25 hours and $1.99 for each additional hour spent online. The Family Surfer plan jacks up the basic online time limit to 100 hours; this plan costs $35 without ISP service and $50 with. Additional hours are billed at 99 cents and $1.99, respectively. If you're so inclined, you can opt for the Office Surfer package, which provides 200 hours of online time and ISP service for $130 per month. The Office Surfer plan is the only one to offer multiple e-mail accounts.

You'll also have to pay for hardware, plus installation charges if you decide you're not handy enough to drill holes in your house. The hardware costs $100 to $300, depending on what level of service you're buying. Installation charges range up to $300.

If you opt for DirecDuo (PC and TV service), you'll have to purchase a separate system receiver to receive the TV portion of the service. TV service can cost up to $500, depending on features and capabilities. Unfortunately, Hughes doesn't offer any price incentives for going with DirecDuo.

Where can I get it?

In theory, DirecPC is the only broadband technology that's available to everyone in the United States. The only qualifier is that your satellite receiver needs a "good line of sight" to the south. The satellite that delivers the DirecPC service is in a geosynchronous orbit above the equator, meaning the satellite keeps pace with the earth's rotation, so it always stays above the same place on the earth's surface. If tall buildings, a forest of trees, or a snow-capped mountain peak obstruct the transmission line between your receiver and satellite, you're ass-out.

REAL-WORLD BENCHMARKING

Each of the four content transfer tests was conducted between 8p.m. and 9p.m. on three successive weeknights. Fastest times achieved are reported in min:sec.

maximumpcmag.com front page download	8.4MB MP3 Usenet download	15MB netscape.com FTP download	5.25MB AVI e-mail attachment upload
56K - 0:34	56K - 23:35	56K - 190:00	56K - 39:21
0:29	**3:30**	**8:31**	**36:28**

Our satellite tests were conducted with 400Kbps/33Kbps DirecPC. While it's clear that satellite technology offers tangible benefits over 56K modems in big file downloads, it's equally apparent that big file uploads will break your heart. And what's up with that web page download score? We can only say that any downloading activity can be affected by the variable conditions of content servers and Internet backbones. Still, the DSL and cable technologies downloaded our front page just fine.

The Hold-Up In Your Hood

Aside from the line-of-sight issues, you might also be stymied by homeowner associations that restrict the installation of satellite dishes on building exteriors and rooftops. Some communities might allow satellite dishes, but have restrictions on height. If you're living in an apartment building, ask your super if it's OK to place a satellite dish on your rooftop or south-facing balcony, fire escape, or window sill.

Line-of-sight issues in any situation can be addressed by installing the dish at ground level with a secure mounting pole. Just make sure the pole can withstand wind gusts. Or a category-4 hurricane.

Hardware Required

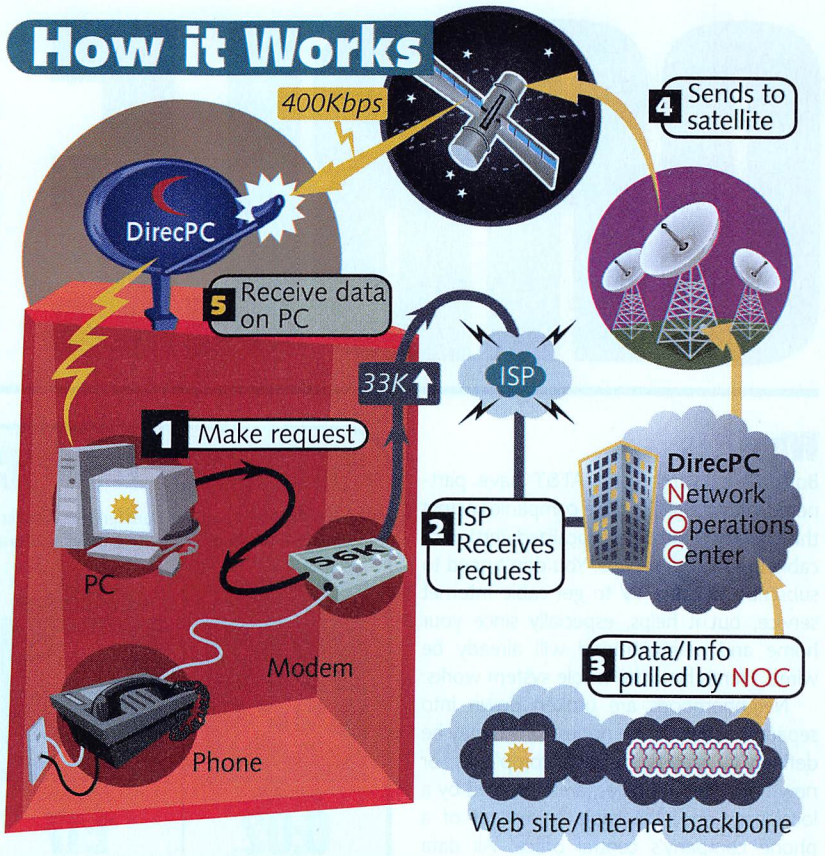
If you don't already own a compatible satellite dish, Hughes will sell you a dish, along with a USB- or PCI-based "satellite modem" that plugs into your PC on one end and receives the dish's coaxial feed on the other end. We shouldn't have to tell you that you'll also need a PC, a 56K modem, and a telephone line. But we will. And we just did. You'll also need a TV satellite receiver system for DirectDuo if you're planning on watching that "Small Wonder" marathon that airs out of Belize.

Installation

You can hire a local Hughes subcontractor for the installation or you can do it yourself. If you're prone to vertigo, you really shouldn't be stumbling across the rooftop with expensive hardware. But assuming you're your own handyman, here's what to expect:

First, assemble and mount the satellite dish on the roof (for safety's sake, use a sturdy ladder). Once the dish is secure, drill a hole in the side of your house or roof through which you can snake the coaxial cable through. We recommend that you use a power drill and do your best to avoid hidden gas and electrical lines. Once the cable is safely ensconced in the wall, seal the hole with a bit of silicon to prevent water damage and dry rot. Then pull the cable through the hole in the wall interior and affix a wall faceplate.

Next, connect the coaxial cable to the satellite modem adapter attached to your PC, attach your telephone line to your PC's modem, and power up the satellite modem and PC. After you finish installing the DirecPC software, you'll need to manually adjust the DirecPC dish. When you reach the "antenna pointing" screen, you'll record the elevations, magnetic azimuth, and polarization values. To get the strongest signal, you'll have to manually realign the dish.



DirecPC is unique in its simplicity. All upstream commands (such as a URL request or an e-mail upload) are sent via PC modem to DirecPC's Network Operations Center. The Center then sends the request to the web site, receives the data requested, and shoots it up and over to the DirecPC satellite, which beams it down to your DirecPC dish and into your PC.

Caveats/Problems

▶ **If you already subscribe** to DirecTV and want to get DirecPC, you'll have to buy a new dish. Only the DirecPC dish, which is slightly larger in diameter, can support both transmissions.

▶ **In severe weather**, you may experience "rain fade," a degradation of the

CONTINUED ON PAGE 56

SATELLITE TIPS

▶ If you want to feed DirecDuo TV signals to your PC, you'll have to invest in a TV-tuner card and split the DirecDuo feed to both your TV and PC.

▶ If you're planning to send a lot of e-mail attachments or run a server from your house, stay away from DirecPC. The upload limitation of 33Kbps will all but kill any possible broadband enjoyment.

▶ DirecPC Network and Enterprise editions are geared to support LAN environments.

▶ The DirecPC software has a built-in signal strength detector. Depending on where the dish is pointed, your signal strength can range from 10% to 125% (the higher the value, the stronger the signal). Setting up the system is thus best accomplished by two people: one to monitor the software, the other to manually move the dish according to the software signal-strength reports.

▶ DirecPC also provides broadcast delivery of web sites and newsgroups. Turbo Webcast and Turbo Newscast data is sent at pre-determined times and cached on your hard drive.

definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

CABLE

Recent studies show that more than 70% of U.S. households are wired for cable TV. If you're part of this status quo, chances are good that you'll be able to buck the broadband bronco atop the very same coaxial cable that carries "X-Files" reruns to your tube. There are currently two major players in the cable arena: Time Warner/Media One's Road Runner service, and AT&T/TCI's @Home service, which was available to us for local testing.

What It Is

Both Time Warner and AT&T have partnered with major TV cable companies across the country to provide a localized version of cable broadband service. You don't need to subscribe to cable TV to get cable Internet service, but it helps, especially since your home and neighborhood will already be wired. Here's how the whole system works:

Neighborhoods are broken down into separate nodes. These nodes, which may be defined by streets, housing complexes, or new home communities, are all served by a local head-end, the cable equivalent of a phone company's central office. All data from each local head-end gets aggregated at a regional data center (RDC), which then talks to a nationwide backbone for entry to the global Internet.

All houses on a specific node transmit data on the same pipe to the local head-end. The local head-end can cache web sites that are popular in a particular area, based on a series of predefined metrics. Because the data is cached in the head-end, all subsequent user requests are served posthaste, with no delays—even if the global Internet is congested.

Sharing a common pipeline is cable's bane. When you're on the pipe alone, you enjoy the technology's maximum bandwidth. But when 50 of your neighbors jump on, each individual's bandwidth drops accordingly. Sharing a common pipe also raises the possibility of security breaches.

How Fast Is It?

Because it uses a shared-pipe model, cable's bandwidth is difficult to peg. DOCSIS, a new interface standard for cable modems, supports speeds up to 30Mbps both up and downstream. Your actual bandwidth will vary, of course, depending on how many people from the same node are online simultaneously (congestion usually occurs from 7p.m. to 10p.m. on weekdays).

Bandwidth is also dependent on your PC itself—how fast your Ethernet connection is, the physical limitation of the USB bus, and the speed of your processor. On average, you should expect speeds anywhere from 300Kbps to 10Mbps, which are well within the range of most DSL offerings. Of course, your actual speeds can vary minute to minute, hour to hour, and day to day.

Although @Home is downright coy about its actual bandwidth offerings, Media One isn't. A press spokesperson told us Media One throttles its service back to a maximum of 1.5Mbps downstream and 300Kbps upstream to provide a consistent experience, no matter the time of day or how many users are online simultaneously.

How Much Does It Cost?

Generally, both Road Runner and @Home cost about $40 per month, though pricing can range from $35 to $55. This includes unlimited usage, multiple e-mail accounts, always-on connectivity, 5MB of web space, and the rental cost of the modem. Cable TV service costs extra. However, local cable companies are free to set their own prices, and you may score a deal if you subscribe to both services.

Installation generally costs around $100, but you can always negotiate the fee when you call to set up service. Most companies offer special deals, and even if they don't, it's always good to haggle. The service technicians we spoke to all agreed that you can probably get a free installation if you try hard enough.

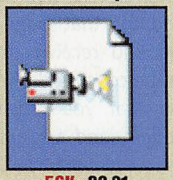
Where Can I Get It?

According to Getspeed.com, approximately 20% of U.S. homes that already subscribe to cable TV can also receive cable Internet access. At press time, more than 1 million users had already taken the plunge. Compared to DSL, cable Internet access is more widely available, with only a handful of states—including Alaska, South Dakota, Vermont, West Virginia, Wyoming, and North Dakota—bowing out of the bandwidth rodeo. The states with the widest deployments include California, Florida, New York, Texas, and Michigan.

As expected, you'll have to check with your local cable company to see if your area

REAL-WORLD BENCHMARKING

Each of the four content transfer tests was conducted between 8p.m. and 9p.m. on three successive weeknights. Fastest times achieved are reported in min:sec.

maximumpcmag.com front page download	8.4MB MP3 Usenet download	15MB netscape.com FTP download	5.25MB AVI e-mail attachment upload
			
56K - 0:34	56K - 23:35	56K - 190:00	56K - 39:21
0:02	**1:17**	**2:48**	**8:29**

Our cable tests were conducted with @Home service using a Motorola Cybersurfer Wave modem capable of 30Mbps/1.5Mbps throughput. While our fastest cable time beat our fastest DSL time in the FTP download test, overall cable performance exhibited wild variance: Our slowest cable-driven 8.4MB MP3 download took 3:35; our slowest cable-driven 15MB FTP download took 10:01. DSL variance, meanwhile, never fluctuated by more than 30 seconds in any test (and DSL uploads kicked cable's butt, too).

is being served. Be forewarned: You should double- and triple-check before you take no for an answer. When we called to have @Home service installed in Dublin, CA, we were told twice that service was not yet available in our area, even though it was. Also, if you've just moved into a newly built community, let the cable company know exactly where your new street is located. If the customer service reps are using older maps, your new address may not exist in their database. So, even though service can be installed, you'll be told that it can't.

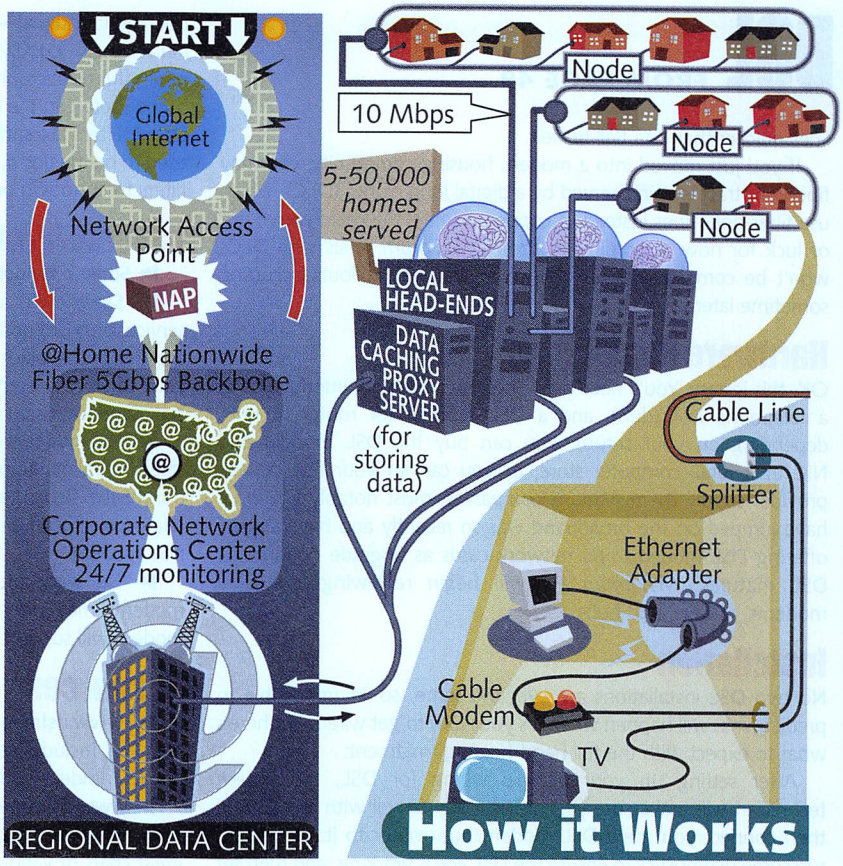
The Hold-Up In Your Hood

The telecommunications architecture that cable companies have been using for the last 20 years has always been one-way in nature. As a result, to give you broadband, cable companies have to replace the old one-way system with a two-way fiber-optic-based network that supports high-speed data transmission. Unfortunately, this takes time and money—lots of both. In fact, over the past couple of years, national cable companies have spent an estimated several billion dollars to convert and upgrade urban areas. Count yourself lucky if your area has already been converted. Otherwise, there's not much else you can do but wait.

Nonetheless, you really have to admire fiber-optic bandwidth. A typical fiber-optic cable, approximately 1.25cm in diameter, can carry in excess of 2.3 million simultaneous voice calls—about 484 times as much information as a 10cm copper line.

Hardware Required

You'll need a cable modem and a USB Ethernet adapter. You can buy either piece of hardware yourself, but it may be best to let your provider furnish the modem to ensure compatibility. No NIC is necessary, but you may need a cable splitter (also furnished by your provider).



Cable provides very fast bandwidth and caches popular web site content to expedite your online experience. The downside is its shared pipe—the more people on the same neighborhood node who are online at one time, the less bandwidth there is to go around.

Installation

No two home installations will ever be alike. However, if your PC is located near a cable TV outlet, installation will be a piece of cake. Otherwise, the cable installer may have to wire the room, snake cables through the attic, or bring 'em in from the outside.

Once the physical cable terminus is established, the service technician will test your PC to ensure there are no conflicts detected in the system. From there, he'll hook up the modem, plug in the cable line, and connect the modem to an Ethernet adapter, which will likely be hooked up to a free USB port. Once he completes the hardware connections, the technician will boot up your PC, install some software, take line measurements, test your PC again, and—if everything is working as it should be—get back in his truck and leave. You're now ready to explore your new broadband access with wide-eyed excitement.

CONTINUED ON PAGE 56

CABLE TIPS

▶ If you're concerned about security, disable file sharing in your PC. Cable users are conceivably more susceptible to hackers because everyone shares a single node. However, it's important to note that most cable modem data is encrypted during transit.

▶ For an extra fee, you can install cable service on two PCs to set up a home-networking environment.

▶ You're not obligated to also subscribe to cable TV. Don't get bullied into paying for both services if you don't want 'em.

▶ Don't dismantle your PC before the installer arrives. They'll run tests to make sure the PC is running properly before and after the installation.

▶ Keep a spot open on your surge protector for the modem.

▶ It's important to know which cable company might be your provider. Road Runner service is primarily available to cable subscribers serviced by Time Warner and Media One. @Home partners with the remaining cable operators, including AT&T/TCI in the United States, and Rogers, Cox, and Shaw in Canada.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

DSL FROM PAGE 49

lines quicker than Ma Bell herself.

If you just moved into a modern housing community, you may find your tract is being served by a digital loop carrier (DLC), which use fiber-optic lines instead of copper. If this is the case, you're out of luck for now. According to the ADSL Forum, trials with DLCs won't be completed until early next year, with rollouts occurring sometime later.

Hardware Required

OK, this is easy. You'll need a PC (natch), a network interface card, a telephone line (duh), and a DSL modem (or router or hub, depending on your setup). You can buy the DSL modem and NIC at a retail computer store, or you can let your DSL service provider supply them. Various companies, most notably Compaq, have jumped on the broadband wagon recently and have started offering DSL modems and network cards as upgrade options. As DSL matures, *Maximum PC* will begin reviewing individual modems, routers, and hubs.

Installation

No two DSL installations are ever the same, so it's impossible to predict what will happen when it's your turn to get wired. But here's what to expect with the full hand-holding treatment:

After setting up your internal wiring for DSL, the service technician will make sure your PC is ready to roll with a NIC, and then connect your new DSL modem/hub/router to it. Next, he'll run some diagnostics to ensure the DSL line is working, and then set up your computer's internal networking software for things such as virtual paths and static IP addresses. The entire installation process can take up to two hours if everything works properly.

Cheap phones can actually interfere with a DSL line's high-frequency data signal—your voice signal literally leaks noise into your data signal. Luckily, many DSL service technicians now carry a handful of microphone filters that connect to the phones in your home (between the phone and the phone line). In many cases, the phone filters are sufficient to clear up the signal. Although splitters used to be the norm, many DSL providers are moving toward phone filters to cut down on installation costs and service times.

Caveats/Problems

▶ **Some providers** guarantee always-on service, some don't.

▶ **Slowdowns** aren't applicable only to cable and satellite service; they just occur at a different place in the chain. In DSL's case, the CO is the place voted "most likely to cause a slowdown" in your service. If everybody in your DSLAM area tries to go online simultaneously, you will doubtless experience bandwidth problems.

▶ **DSL modems** can be finicky. Some modems have inadequate shielding, allowing power surges from large electrical appliances to disrupt the signal going to the modem. Don't plug non-computer-related electrical appliances into the surge protector used by your DSL modem.

▶ **Be wary** of PCs touting broadband capability. Bundled modems may offer only limited 1.5Mbps capacity. Ideally, your modem will support up to 6Mbps of bandwidth (think upgrading).

Resources

▶ **www.dslreports.com** An incredible DSL service and news resource. Includes user forums, diagnostic tools for speed and security, CO finders, and everything else.

▶ **www.dslprime.com** A useful, independent DSL resource.

▶ **www.dsllife.com** The "where it's available" link provides a great chart of various providers' access plans.

▶ **www.getspeed.com** Enter your address and phone number to determine availability and get a list of active providers in your area.

▶ **www.speedguide.net** Find a list of DSL performance tweaks.

Satellite FROM PAGE 53

signal. Short of a dalliance with Mother Nature, there's not much you can do to prevent this—other than making sure the equipment is installed properly.

▶ **DirecPC/DirecDuo** doesn't work with AOL.

▶ **If you're an online gaming fanatic,** don't get DirecPC! Because upstream bandwidth is handicapped by your modem, you won't experience any faster ping times. Hughes' own web site states "there is no benefit to using DirecPC [when playing games]."

Resources

▶ **www.direcpc.com** The web site of the only consumer-level, satellite-driven bandwidth game in town.

Cable FROM PAGE 55

Caveats/Problems

▶ **Running a server** from your home is prohibited by most cable Internet providers. They don't want you to eat up all the shared bandwidth.

▶ **Some cable providers** intentionally limit upload and/or download speeds to provide consistent bandwidth for all. This is called "capping" or "throttling back" the service. Find out if your cable provider does this, and to what degree.

▶ **Be wary** of speed claims. @Home, for example, says its service is "up to 50 times faster than a 56Kbps modem" and nothing more. They don't even distinguish between up and down speeds.

▶ **Some cable ISPs** will allow domain hosting; others will not. Check with your cable provider to make sure.

▶ **Stay away from** "one-way" services that require the use of an analog modem.

Cable resources

▶ **www.home.com** Official site for TCI @home service.

▶ **www.rr.com** Official site for Time Warner/Media One Road Runner service.

▶ **www.cablemodeminfo.com** A great kitchen-sink site for cable broadband users.

▶ **www.cablemodemhelp.com** The name says it all.

▶ **www.cabletraffic.com** Includes software that tracks cable usage and interruptions.

▶ **www.speedguide.net** Includes a list of cable modem performance tweaks.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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High-speed access: Dare to compare

First off, you *are* getting broadband net access. If you're a *Maximum PC* power user, broadband access is a non-negotiable, must-have feature. End of story. That said, you need to decide which pony to saddle up and ride in the rare event all three broadband technologies are available to you. Here's the basic breakdown. Giddy-up!

	DSL	Cable	Satellite
PROS	Uses standard phone lines. It's always on.	Uses standard cable lines. It's always on.	Available almost anywhere.
	You don't have to share the line.	Offers value-added portal sites that serve local information.	Lowest monthly service charges.
	Bandwidth can actually exceed the speed promised by service plan.	Privatized backbones/ head-ends cache popular sites.	Offers DirecTV access, too.
	Numerous providers; more on the way.	Currently available in more areas than DSL.	Includes "push" services.
CONS	Fast access can be expensive.	Hard to gauge true bandwidth.	Requires a phone line, so it's not "always on."
	Inconsistent pricing from provider to provider.	Potential security issues with sharing line.	Upstream is limited to modem/phone speed.
	You need to be close to Central Office for optimal performance.	Sharing line can reduce overall bandwidth.	Requires line of sight to the south.
	Not available in all areas.	Not available in all areas.	Tends to attract NASA geeks.
Slowdowns occur at	The Central Office or DSLAM.	The node level on the way to the local head-end.	The modem level that handles all upstream commands.
Maximum speed downstream	8Mbps *	30Mbps **	400Mbps
Maximum speed upstream	1Mbps *	30Mbps**	33Kbps
Average cost per month (with ISP)	$50	$40	$30

* Actual speeds may vary. ** Per the DOCSIS specification. Actual speeds may vary.

Wherefore art thou, ISDN?

Until DSL is ubiquitous, 56K modems aren't going away. After all, not everybody and his dog really has a need for high-speed Internet access. ISDN, however, which was originally targeted at small- to medium-sized businesses, definitely has a shortened life span. "ISDN has always been more of a secular business technology and not very consumer-friendly," said Frederick Von Oldenburg, Compaq's Broadband Strategy Manager. "As soon as broadband becomes readily available, it's dead."

Part of ISDN's problem is cost. Its typical $35 monthly charge is certainly in line with other broadband technologies. But when you factor in its speed—up to only 128Kbps for combined voice and data—it doesn't make sense. And that 128Kbps threshold is only good for one task. If you get a phone call while surfing the net, your transfer rates will drop to between 56Kbps and 64Kbps; not much faster than a traditional modem. ISDN is also metered: You're allotted a number of evening and weekend minutes per month, and have to pay a per-minute-charge for any daytime accesses.

When all is said and done, it's time to say goodbye to ISDN. To tell you the truth, we never liked it much anyway. Give us cheap 56K or give us broadband. May ISDN rest in peace.

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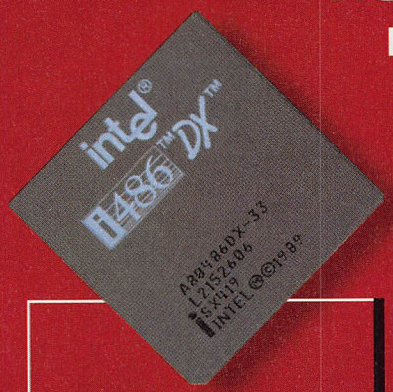
RESURRECT YOUR 486

HOW TO TURN YOUR OLD PC INTO A NO-NONSENSE WEB TERMINAL



Old computers always get the short shrift. For all their hard work, they're lucky if you put them in the closet rather than sending them straight to the crusher. But your average discarded computer has a surprising amount of horsepower left under its hood.

Don't get us wrong—we've come a long way since the days of the 486, and nobody in his right mind is going to trade in a 21st-century powerhouse for 1994's award-winning computer. But inside that yellowing husk is a smart web terminal dying to get out. Hook it up to your broadband connection for a cheap "second box," or give it to your grandma; she says she wants to get online, but you know full well she has no need for unmitigated PC power.

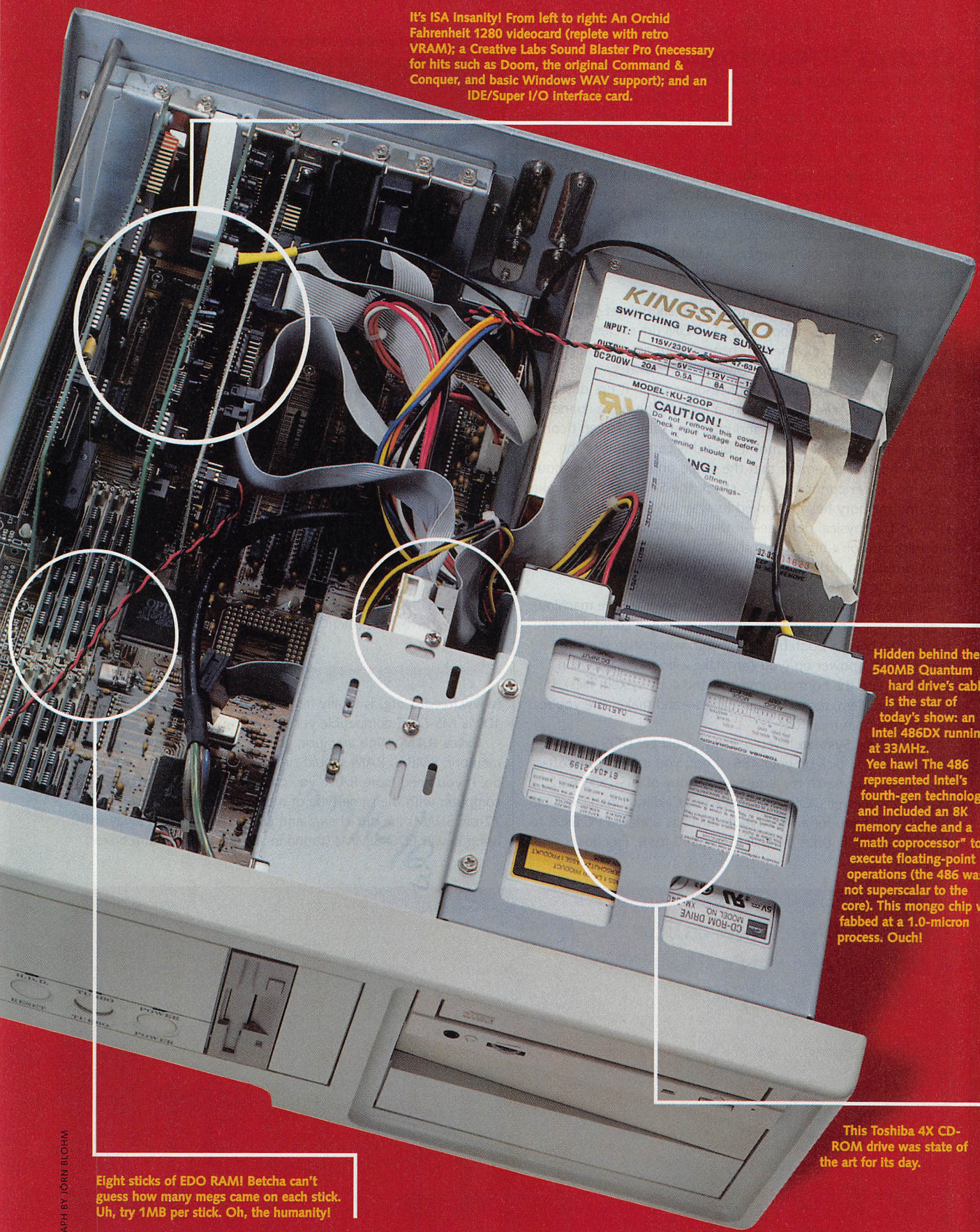
Take a break from obsessing over modern problems—P-III or Athlon? Voodoo or TNT?—and put that old DOS box back to work. The free Arachne DOS web browser we'll be using incorporates FTP and e-mail clients, and supports parts of the HTML 4.0 spec, including tables, frames, image maps, and forms. The downloads won't be "museum-quality," but they'll give you the data you need in a pinch.

INGREDIENTS

You'll need the following for this project:

- 486 Computer
- Hard Drive
- CD-ROM Drive
- Soundcard
- Modem/Ethernet card
- DOS Installation disks
- Monitor
- Screwdriver
- Can of Compressed Air

by Jason Compton



It's ISA insanity! From left to right: An Orchid Fahrenheit 1280 videocard (replete with retro VRAM); a Creative Labs Sound Blaster Pro (necessary for hits such as Doom, the original Command & Conquer, and basic Windows WAV support); and an IDE/Super I/O interface card.

Hidden behind the 540MB Quantum hard drive's cabling is the star of today's show: an Intel 486DX running at 33MHz. Yee haw! The 486 represented Intel's fourth-gen technology, and included an 8K memory cache and a "math coprocessor" to execute floating-point operations (the 486 was not superscalar to the core). This mongo chip was fabbed at a 1.0-micron process. Ouch!

This Toshiba 4X CD-ROM drive was state of the art for its day.

Eight sticks of EDO RAM! Betcha can't guess how many megs came on each stick. Uh, try 1MB per stick. Oh, the humanity!

PHOTOGRAPH BY JÖRN BLOHM

Going Shopping...

The best strategies for picking up old computer gear depend on how much time you have on your hands. Obviously, the first order of business is to check your own closets, along with those of your closest friends, relatives, and neighbors. Flea markets and thrift stores are also good targets. Garage sales can be hit or miss, but remember that many families bought 486/50 "multimedia" machines back in the day. You might even try making nice with a computer center manager at a local public school, university, or corporation. Or do a little dumpster-diving at said establishments. It's amazing what bureaucracies will throw away.

Now, for some specific buying tips:

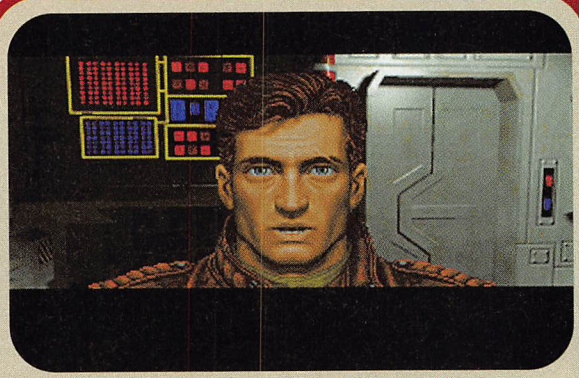
The Computer Itself Less than $100 should get you a computer with hard drive, floppy, and CD-ROM drive. Desktop-profile machines tend to be the cheapest, but are also much more difficult to upgrade than towers.

To give an old machine the once-over, open it up, dust it off with compressed air, and take a look at the drive connections. Make sure the power and interface cables haven't come loose and check that the motherboard is connected to the power supply. Remember that the stripe on drive cables should face the power connector. Also check the SIMM slots to make sure the memory hasn't worked its way loose. Be on the lookout for physical damage—if there are stains all over the motherboard or a big dent in the hard drive, you're going to have problems. If there are ISA cards in the computer, make sure they're tightly seated.

Plug in a monitor and keyboard, and power up the machine. If all is well, it'll boot right up. In case you buy a computer sans hard drive, bring a bootable floppy with you just to see if the computer will power up (you can make a bootable floppy in Windows; use the Format command and copy system files). If there's a problem, recheck those cables—and make sure you're not using a bum monitor.

Operating System If you're lucky, you'll get DOS installation disks when you pick up your 486. If not, you can go to a software store and search for a dusty, $10 copy of MS-DOS 6.22, PC DOS, or Novell DOS. Also check out Caldera/Lineo DR-DOS (**www.lineo.com**) for a free tryout. IBM has updated PC DOS to PC DOS 2000, but has the gall to ask $50 for it. Freedos (**www.freedos.org**) is totally free and OK in a pinch, but it's not 100% MS-DOS-compatible yet.

Extra RAM: With any luck, you won't need to add any memory; 8MB of RAM should suffice for most anything you'll do. If you need more RAM, you could just pick up a second computer with the same type of memory and cannibalize it. 72-pin SIMMs are dirt-cheap, and you can usually get away with using newer EDO SIMMs (found in second-gen Pentium boxes)



The original Privateer from Origin/EA was a lot of fun, but notoriously hard to run in Windows 95, even with a boot disk. This brooding space combat/trading simulator has a creepy soundtrack and several gloomy threaded storylines. Lots of fun.

Funky 486 Fragging

Your spankin' 486 browser box can easily double as a retro gaming machine. To this end, you'll definitely need a gaming soundcard and a dime-store joystick. You should also experiment with the memory-management steps detailed on page 71. In general, the more conventional memory you have available, the better; some games require 580K or more.

CompUSA often hides old games in its bargain bins. Interplay and Sierra have made some extra dough by re-releasing portions of their back catalogs. Some companies have even released titles as freeware. Explore!

DOS REFRESHER GUIDE

Even though DOS apps feature graphical user interfaces, the OS itself is still command-based. To play with a 486, you'll need to know some DOS basics (they're damn helpful when doing Windows machine maintenance, too). Feel free to practice these commands in the MS-DOS Prompt (a program on your Windows Start menu), and if you need even more help, go to the EasyDOS guide at **www.csulb.edu/~murdock/easydos.html.** Just remember not to execute any command that might muck up an already-stable system configuration.

dir List all files in a given directory. Can be used with a path (for example, `dir D:\games`) to show the contents of subdirectories. Use an asterisk to denote wildcards (for example, `dir *.exe` lists all .EXE files). Make liberal use of the pause suffix to keep long lists from flying off the screen (for example, `dir c:\ /p`).

cd Change directory. The command `cd \` takes you to the root directory while `cd..` moves you up one level. The prompt should give your current path location.

copy Creates a copy of a file in another location. Syntax: `copy <source path and name> <destination path and name>`. Remember the nuances of the path in DOS. `C:\` refers to the root directory, but `C:` refers to the last visited location—which is the root directory when you start up, but could be `C:\foo\bar` if that was the last directory you were working in. This shortcut is for copying files without having to type in a really long path. (For example, the syntax `copy file.txt c:` will go to c:\foo\bar if that's where you were last.)

del Delete a file. Syntax: `del <path and filename>`.

mkdir Create a new directory. Syntax: `mkdir <path name to new directory>`.

deltree Wipe out a directory and its contents. Handle with care. Syntax: `deltree <path>`.

mem Displays detailed information on memory allocation and usage.

edit Invokes a text editor. Good for editing configuration files.

help The latest releases of DOS all have detailed online help for each command. Use it. Syntax: `help <command name>`.

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Female Premiums

Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
35	$ 280	$ 320	$ 465	$ 580	$ 660
40	$ 310	$ 450	$ 590	$ 770	$ 860
45	$ 560	$ 700	$ 860	$ 1,100	$ 1,320
50	$ 860	$ 1,050	$ 1,295	$ 1,560	$ 1,755
55	$1,280	$ 1,480	$ 2,035	$ 3,130	$ 3,850
60	$1,830	$ 2,250	$ 3,195	$ 8,330	$ 9,420
65	$2,920	$ 3,670	$ 5,855	$15,420	$ 15,420
70	$5,110	$ 6,220	$11,700	$29,340	$ 29,340
75	$8,920	$19,375	$23,100	$41,580	$ 49,680

Male Premiums

Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
35	$ 325	$ 400	$ 545	$ 740	$ 885
40	$ 410	$ 550	$ 720	$ 970	$ 1,130
45	$ 740	$ 1,020	$ 1,112	$ 1,650	$ 1,930
50	$ 1,235	$ 1,665	$ 1,677	$ 2,550	$ 3,080
55	$ 1,880	$ 2,550	$ 2,940	$ 6,290	$ 9,095
60	$ 2,985	$ 3,830	$ 5,100	$14,340	$14,340
65	$ 5,155	$ 6,470	$ 9,885	$20,820	$20,820
70	$ 9,335	$11,715	$19,260	$34,980	$34,980
75	$17,420	$29,665	$38,220	$52,860	$60,120

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in non-EDO machines. Used SIMMs are hard to sell, so people should be glad to toss them for $1 per meg.

Hard Drive/CD-ROM Any decent 486 will have a BIOS that can read the configuration off of a modern IDE drive, although for safety's sake, you may want to steer clear of Ultra DMA 22GB jobs. As for CD-ROM drives, if you can find an old 2x or 4x drive, it should do just fine with the default DOS CD driver.

Monitor 14-inch VGA monitors have practically zero resale value, so play that to your advantage if you don't already have an extra CRT taking up space. Don't pay more than $50 for a mint model.

Modem Hopefully, your machine will have a 16550 UART serial controller, allowing you to use an external 28.8 modem or some other piece of driftwood, and avoid IRQ/COM settings issues. If it doesn't, you can buy a new serial card for a few bucks, or dig up an internal modem. If you do go internal, make sure you don't get a fancy new Winmodem, which will be useless in DOS. Don't pay more than $20 for 1995's hottest modem.

Ethernet card (optional) You can plug a cable or DSL modem into a DOS box, if you're really resourceful. With new ISA Ethernet cards selling for under $20, it's hardly worth the bother of shopping for a deal. Just be sure you get a DOS driver disk (or visit **www.crynwr.com** if you need drivers).

Soundcard If your 486 didn't come with a soundcard, try to beg, borrow, or steal a genuine Creative Sound Blaster classic, Pro, or 16. An old card shouldn't cost more than $15 to $20. Don't go too far into off-brand "SB-compatible" territory, if you can avoid it.

Before you touch anything...

Before installing your DOS net software, you need to make sure your 486 is in optimal working order. If you're starting with a preassembled system that boots cleanly to a DOS prompt, don't screw around with it until you make a backup of the AUTOEXEC.BAT and CONFIG.SYS files (generally found in the C:\ directory). Better yet, copy the files to a floppy that you won't lose, and then make a printout of the file contents. This way, if you want to upgrade to a newer DOS version, you can see what files and drivers are being used in the original configuration—very important in case the upgrade process botches your system.

Here's a quick FAQ on 486 renovation:

Q: *Hey! The computer says there's a CMOS memory failure, and the date is 1980! What's this?*

A: The battery backup in the computer has died. They're rechargeable batteries, but they lose their charge after a year or two of idleness. Check the motherboard: If the battery is a disc-style "button," it should be relatively easy to find a replacement at a computer store or in a catalog. If it's soldered to the motherboard, there's still hope—many computers have an "external battery" header near the onboard battery, and the replacement is a fairly standard part. You may have to switch a nearby jumper to tell the computer to ignore the drained battery. Sometimes the onboard batteries will leak when they discharge and damage the motherboard. If this has happened, consider lining up a new computer.

Q: *My CD-ROM drive doesn't work! What gives?*

A: Older CD-ROMs prefer being plugged into the controllers found on soundcards, rather than the computer's IDE controller. Make sure the device driver for the CD-ROM is loaded in the CONFIG.SYS file (it'll be on a DEVICE= line) and that a CD-ROM handler is loaded in AUTOEXEC.BAT (usually called MSCDEX or NWCDEX). If it's a newer CD-ROM that you're absolutely sure belongs on the computer's internal IDE chain, check the master/slave jumper settings on the CD-ROM and hard drives. The hard drive should be the master.

Q: *I plugged in a hard drive, but it doesn't work! What's up?*

A: Make sure you've set the BIOS to detect the drive, and that you save those BIOS settings when you exit setup. If the drive is unformatted, run FDISK. (This looks scarier than it is—just use the on-screen prompts to create a big primary partition, and don't worry about the esoteric options.) Check the hard drive's master/slave jumper settings, and inspect the cable for damage.

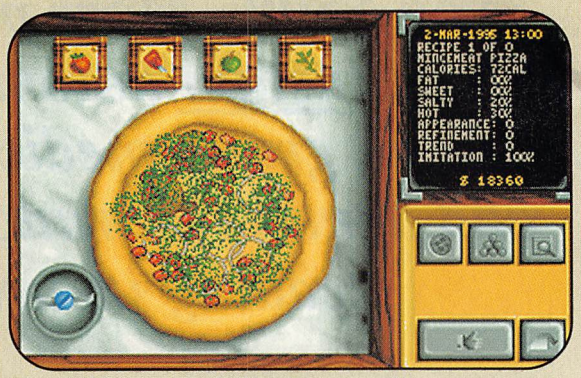
Q: *The computer seems slow, its age notwithstanding. What can I do?*

A: First, check to see that it's not something stupid, like having the "turbo" button jammed in slow mode. Beyond that, you might have an undersized onboard cache (indicated by lots of open chip sockets on the motherboard). Feel free to add more cache, but be aware that adding cache may be cost-prohibitive for a "box-on-the-cheap." It's probably quicker and cheaper to simply hunt down a 486/66 computer if your 25MHz CPU seems too slow.

Q: *Motherboard jumpers look like lots of fun. Can I play with them?*

A: You should really restrain yourself. But since it's sometime helpful to know what the jumpers do—for example, if you need to disable an onboard video chip—you should track down documentation. Many motherboard manufacturers are remarkably good about posting info for their old boards, so check their sites directly. Another good resource is **www.motherboards.org**.

Daffy DOS Gaming



Who could hate a game that blends so many of the serious gamer's favorite pastimes: strategy, guile, and pizza? Microprose's Pizza Tycoon is downright bizarre, has a considerable web following, and is definitely addictive enough to warrant a $10 investment—if you can find it.

Setting Up Your DOS web Browser

To set up your *Arachne* web browser, you'll need the following for a comfortable ride:

- a 486 PC
- at least 8MB memory
- 10MB free hard disk space
- a modem
- *Arachne* DOS web browser

©1999 Council on Computing Power

- Ethernet card and LAN connection (optional)

Pre-installation

1. Make sure your computer is running a form of disk cache (SMARTDRV in MS-DOS, NWCACHE in DR-DOS).

2. If necessary, tweak your memory settings in CONFIG.SYS and AUTOEXEC.BAT so that you have at least 540K free conventional DOS memory (see the Memory Management sidebar).

3. Plug your modem into an available serial port or internal slot. If you're planning to use an Ethernet card, see below for details on changes to the installation.

Installation

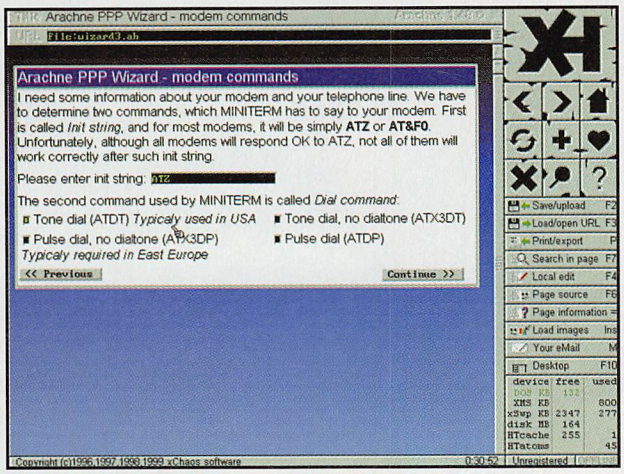
1. Get the latest version of the *Arachne* browser from **http://home.arachne.cz**. It should be a self-extracting (.EXE) archive, and fit easily on a floppy.

2. Copy the large .EXE to a convenient temporary directory on your 486 (see our DOS command guide on page 64).

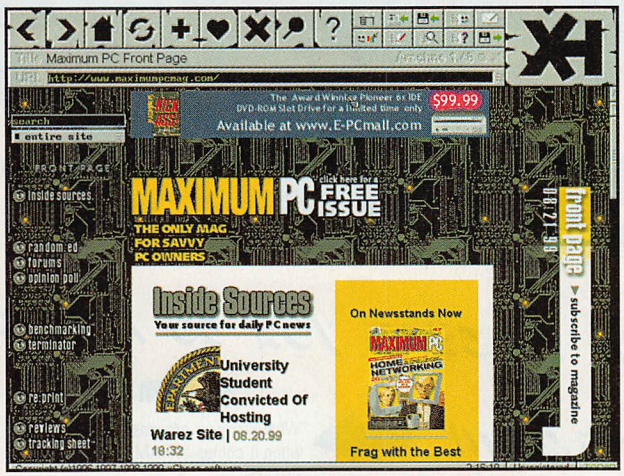
3. Run the .EXE program. The installation archive will be created.

4. Run the included Setup program and follow the prompts. If you're asked to select a video mode, use Autodetect first. Try VESA next. Only select a particular video chipset if you're absolutely sure that's what your PC has.

5. Select a video mode that you know will be compatible with your monitor and graphics card (640x480@256 is usually safe, but you can go larger on better graphics cards and monitors).



Back in the day, modem config was done by hand.



Our web site, as rendered by Lady Arachne. Dig the interface!

Retro-Venturing

In the late 80s/early 90s, LucasArts (then LucasFilm Games) was the king of the graphical adventure. In Loom, Infocom alum Brian Moriarty created a world where music, not props, was the key to solving puzzles. Loom manages to be simultaneously clever and somber, and is a reminder that low-res VGA can still look beautiful.

16-bit color saves *Arachne* the trouble of having to render JPEGs down to a small palette, which can be time-consuming.

6. When *Arachne* loads, you'll be asked to select either PPP or manual TCP/IP setup. Choose PPP. The PPP Wizard will launch. Press "Continue" as appropriate.

7. Let *Arachne* try to autodetect your modem. If it fails, point *Arachne* to the COM port that hosts your modem (usually 1 or 2), or if it's an internal card, usually IRQ 5.

8. Select your modem's BPS rate. Generally, you want to set this as high as possible, although it's a waste to set a 9600 baud modem at 115200bps.

9. If you know of a better setup string for your modem, enter it now. Usually ATZ is fine, although AT&F0 or AT&F1 are sometimes preferred by newer modems.

10. Enter the phone number for your ISP. Be sure to include any dialout prefixes or call-waiting disable codes.

11. *Arachne* can automatically log you in, but it's often better, especially the first time, to log in by hand. Leave the "Show me terminal window" setting on. You will see your ISP's username and password prompt when you connect.

12. Enter your ISP username and password. *Arachne* needs it even if you log in by hand.

13. If your ISP gives you a fixed IP, enter it here. If your IP is dynamically assigned, leave the default setting alone.

14. Enter the IP addresses of your ISP's domain name servers. *Arachne* can't ferret out DNS by itself, so you'll have to ask your ISP for DNS info.

15. Let *Arachne* dial your ISP. Enter your username and password, then press F7 to tell *Arachne* to start the PPP connection. You'll return to the *Arachne* web browser. You're ready to surf!

Now, you can visit millions of web sites from your DOS box. It might be a good idea to visit the Preferences screen (press F10 to get to the *Arachne* desktop, then select Options, Preferences) and disable image loading on a slow connection, or change your color settings. But basically, your clunker is ready for the web.

Arachne also includes an e-mail client. You can configure it right after setting up the PPP dialer, or return later by going to the mail client (press M or click the envelope icon on the screen), then clicking the "setup mail" link.

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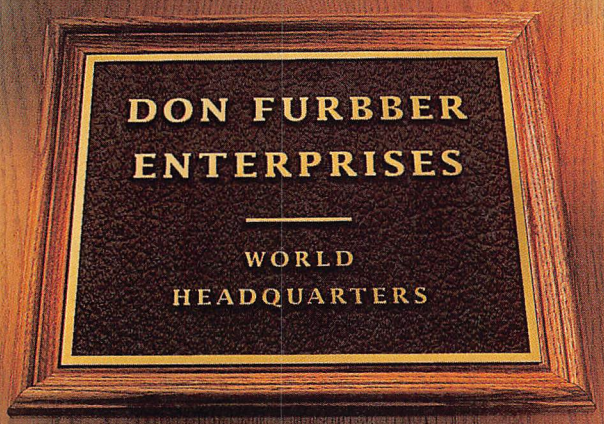

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THE BITCH GODDESS OF MEMORY MANAGEMENT

The facts cannot be mitigated: DOS butchers memory management.

The short story is that the PC industry imposed a 640K limit during the 8088 processor days—no one ever thought we'd need more memory! Sadly, the 640K limit stuck even as PCs graduated to the 286.

Because the 286 needed more memory than the 8088, Lotus, Intel, and Microsoft came up with a spec called XMS that allowed PCs to go beyond 640K. So people configured their machines to have lots of XMS.

A few years later, the 386 came along, and the group of three gathered once again to play around with enhanced memory-management features. The propeller-beanie triumvirate came up with a new spec called EMS. So, people configured their machines to have lots of EMS.

Eventually, some programmers felt that EMS wasn't so hot after all and started requiring that you not only have a ton of XMS, but also that as much of that "conventional" 640K available as possible. Trying to manage all these requirements has always been a real drag.

The later incarnations of DOS—particularly MS-DOS and DR-DOS—made memory management a little easier. MS-DOS has MemMaker, a little utility that sets up a good basic memory configuration. DR-DOS has a menu-based memory utility built into its setup program (which you can get to by typing `setup` at any DR-DOS prompt).

There's no single way to solve all DOS memory problems. Generally, if an app squawks about not having EMS available, it's because the EMM386 memory manager is either not being run at startup in CONFIG.SYS, or it's not being told to create EMS memory.

To make sure EMM386 creates EMS, do the following:

In MS-DOS, EMM386.EXE should create EMS by default. If there is a NOEMS suffix on the command in your CONFIG.SYS file (`EMM386.EXE NOEMS`), remove it. In DR-DOS, use the memory setup program to enable EMS memory, or make sure that `FRAME=AUTO` appears as the suffix on the EMM386.EXE command in CONFIG.SYS.

If a program complains that there is not enough conventional memory available (usually it will say that you need 500-odd K of free memory), try the following:

Start from a basic memory configuration that invokes the EMM386 memory manager in CONFIG.SYS to handle XMS and EMS. Most memory configuration tools will do this by default. Then:

1. Replace any `device` references in CONFIG.SYS with `devicehigh`. This will help free up conventional memory. Even better, put `REM` in front of any nonessential devices or programs to skip loading these items on startup. Your CD-ROM and soundcard initializations are probably essential, but your network card and ANSI.SYS may not be.

2. Try putting `lh` or `loadhigh` in front of commands such as `MSCDEX`, `NWCDEX`, and `MOUSE.EXE` in the AUTOEXEC.BAT file. This puts device drivers in high memory, freeing up more to run your apps. Put `REM` in front of files that look nonessential, such as network client configuration, virus checkers, and so forth.

3. Reduce the numbers in (or REM out entirely) the statements about `FILES=` and `BUFFERS=` in CONFIG.SYS. Note that some programs might need these values set high, so write down the old values for safety's sake.

DR-DOS should have no problem running games with EMM386 enabled. In MS-DOS, you might need to remove EMM386 altogether.

1. Shut off EMM386 by editing the CONFIG.SYS file and putting `REM` in front of the command.

2. Call HIMEM.SYS in CONFIG.SYS (typically done with the syntax `DEVICE=c:\dos\himem.sys`). This statement may already be in CONFIG.SYS or may have been REM'd out by the program that configured EMM386.

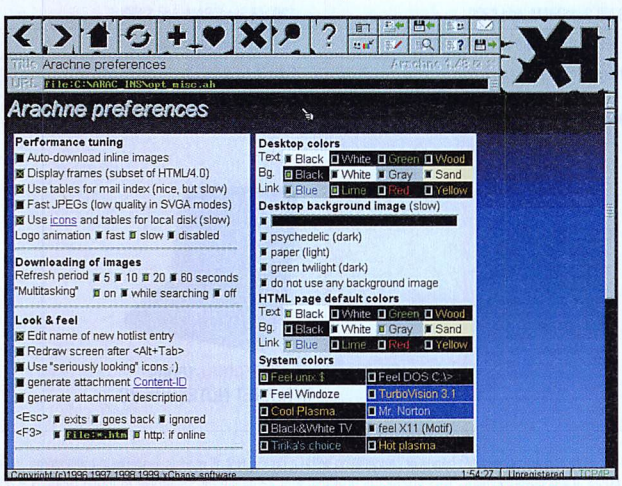
There are many good utilities out there that will help you prepare boot menus or boot disks to automate this tedious fiddling, and let you choose a different memory configuration every time you boot. One of the best is included on the Interplay game compilations of the past few years (Ultimate RPGs, Forgotten Realms Archives, etc.) The games aren't bad, either.

To use *Arachne* on a LAN, setup is similar. The changes are:

1. Before running *Arachne*, make sure that you have loaded the packet driver for your Ethernet card (included on the card's utility disk or available from **www.crynwyr.com**).

2. Use the Manual TCP/IP setup instead of the PPP driver.

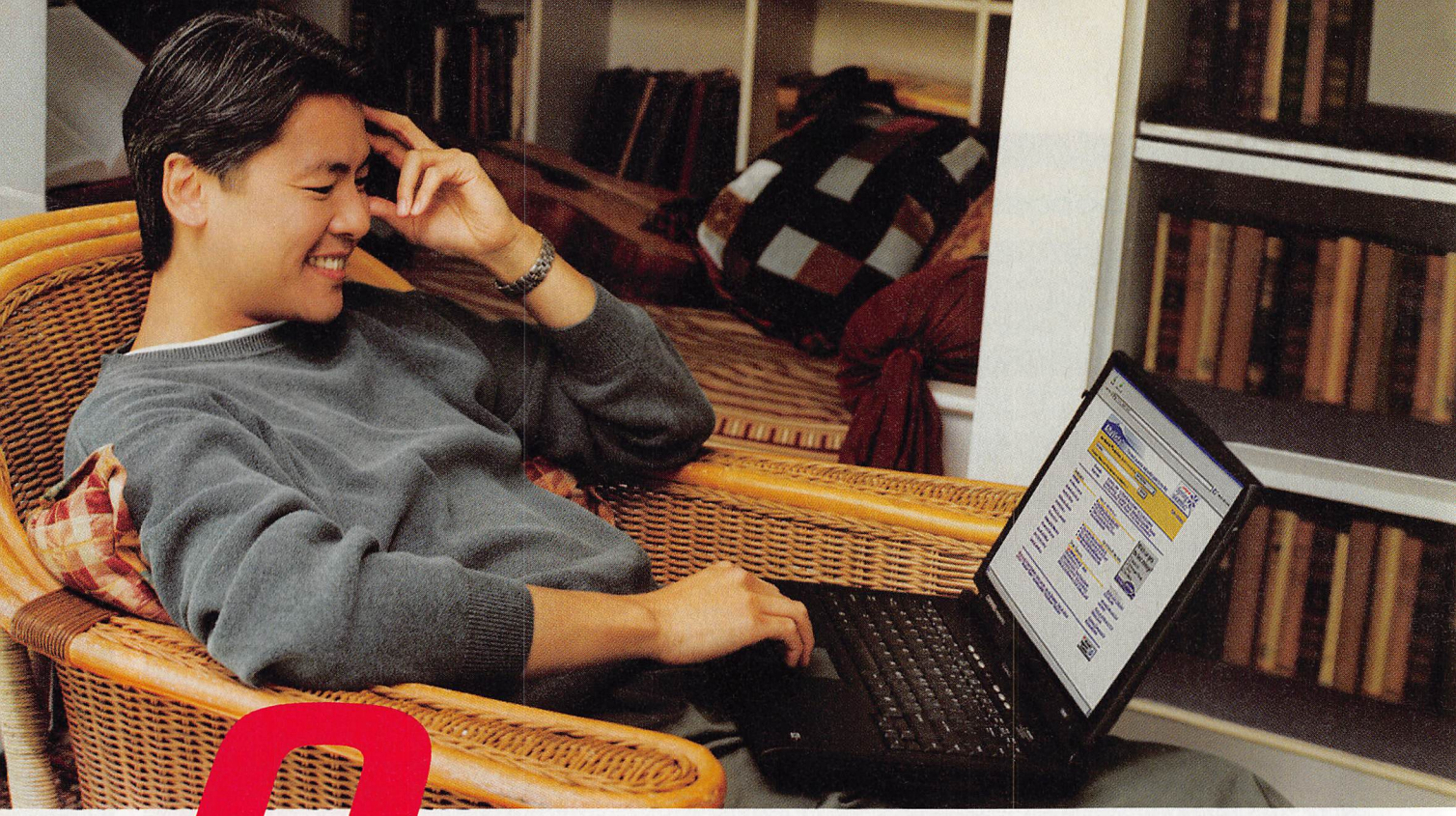
3. *Arachne* supports BOOTP to automatically configure the network, but it's easier if you know your IP, gateway, and DNS information, and enter them manually.



Arachne preferences eases the pain of DOS. But who's Mr. Norton?

Arachne Tips

- If you don't like the default GUI layout, use the shadowed double-arrow button on the *Arachne* toolbar (next to the close-gadget X) to cycle through the screen designs.
- Once you've installed *Arachne*, return to the download page at **http://home.arachne.cz** and download the cool plug-ins: An MPEG video player, music players, a telnet program (good for letting visitors check their mail on other ISPs), and more. And they all install automatically, thanks to the NetDOS protocol.
- *Arachne* isn't perfect. Image-heavy sites can be slow, and some layouts don't render properly. Cookies, Javascript, and secure transfers are also missing. But hey, it's free and running on a 486.
- Read the documentation. Although *Arachne* is relatively easy to install and configure, DOS browsing can be quirky.
- If you don't like *Arachne*, consider its cousin, Caldera *DR-webspyder*, now called Lineo *Embrowser*. *webspyder* is based on the *Arachne* code, but Caldera sped up image loading, improved overall page layout, and added secure transfer support (which is often useless since there's no cookie support). Configuration is a little trickier, and *webspyder* insists on using Novell client support, which takes much more memory than the packet driver. There's also rudimentary Javascript support, although serious scripting seems to crash the browser. The free version works only over a modem—you have to pay for LAN support.



Shown here: Presario 1800T Internet Notebook PC.

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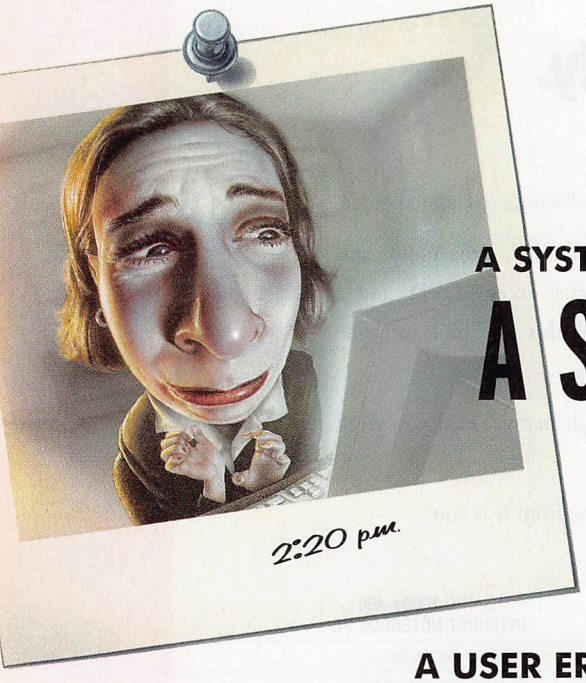

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Learning TO SHARE

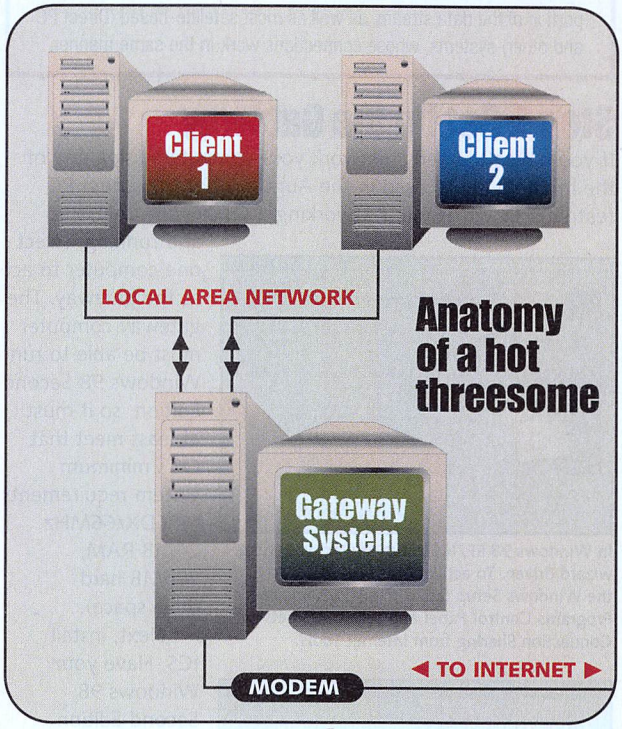
How to Get Multiple PCs Online with One Connection

by Fabian Echevarria

Sharing a modem across several PCs on a network saves money and hassle. And with multiple computers accessing the Internet via a single connection, you can throw out the sign-up sheet for your household's Internet terminal. Faster Internet access is becoming the norm, so there's more than enough bandwidth to share with every PC in your house.

Connection sharing has major benefits. If you currently have multiple phone lines and ISP accounts linking your various machines to the net, you'll save money by canceling those unneeded services. And with only one connection to maintain, you'll have less configuration hassle.

It's never been easier to share a single Internet connection, and we'll show you how to do it from the ground up.



The Basics

Modem sharing entails establishing one computer and one Internet connection as a gateway to be used by other computers on the same LAN. When you set up your computer as a gateway, your ISP and the rest of the world see one computer, although four or five machines could actually be sharing the connection.

Connection sharing can fall under several categories: gateway, proxy, or application proxy. A gateway is a simple route from one network to another; it offers little control over the connection path and what can traverse it. An example of a gateway is a standard ISP connection, which supplies your computer with a default gateway out to the Internet.

A proxy is a more advanced gateway that communicates to the outside world on behalf of your network. A good proxy blocks out all unwanted external connections, routes data through the appropriate network protocols to the outside world, and caches often-used web pages. Sometimes, a proxy can even connect dissimilar network architectures, such as IPX and IP. An application proxy works similarly, but offers control over the applications allowed to communicate over the gateway. This how-to will help you establish a proxy you can use to share your internet connection across your network.

Even with a full-featured proxy and a high-speed LAN, the Internet connection type—whether modem, xDSL, or cable—will still limit the total bandwidth that can be shared. Don't expect to play multiplayer deathmatches on every networked machine through your single 56K modem; the total amount of data that can be sent and received through a single Internet connection doesn't grow when you have multiple PCs sucking on the pipe. If you're looking to route bandwidth-heavy data streams through a proxy, you'll need a connection device capable of meeting those requirements. Only xDSL, certain cable modems, and to a lesser degree ISDN, will deliver adequate performance in this situation.

Surfing by Proxy

Proxy duties can be handled by software or hardware. Several companies provide software proxies, with prices that range from free to very expensive—and as with most things, higher expense translates into more features and capabilities. Low-end solutions provide the basics, such as Network Address Translation (NAT); mid-range solutions tack on useful features such as DHCP and DNS servers, and the ability to filter traffic (a.k.a. firewall functions); high-end solutions usually provide much more robust firewall and security features.

Hardware proxies come in several shapes and sizes, from intelligent hubs to combo modem/routers. Some proxies provide serial ports into which you can jack your connection device, allowing you to start small with a modem and work your way up to ISDN or xDSL, while others are incorporated into the connection device itself. Hardware proxies exist for almost every routing need and use: Hawking sells a single modem/ISDN-sharing hardware router for $149 and Webramp sells a triple-modem/ISDN-sharing device with a built-in hub for $349. Hardware proxies, though quite capable, generally offer more than the average home user needs.

There's a ton of modem-sharing packages out there, but

ILLUSTRATIONS BY SHERRY MONARKO

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

we're focusing this how-to on the new Internet Connection Sharing feature included in Windows 98 Second Edition. Win98's ICS includes basic firewall services, simplified versions of a DHCP server and a DNS proxy, and a 254-user limit. And of course, it's free. ICS's one major drawback is that it can't cache web pages. If you're using an older version of Windows or a different OS, check out the Modem Sharing Software sidebar for a look at what else is out there.

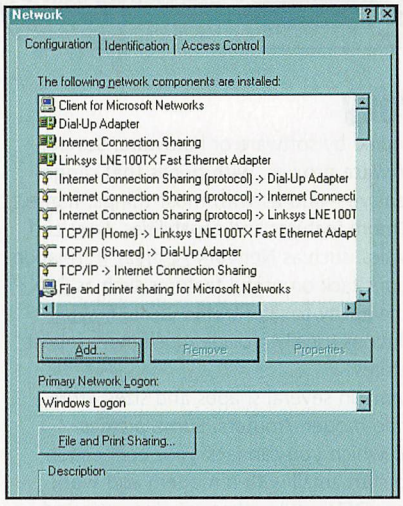
WARNING: Win98 SE's Internet Connection Sharing will not work if your connection uses separate devices for upstream and downstream data channels. Sadly, this includes certain cable modems that use a standard modem connection for the upchannel portion of the data stream, as well as most satellite-based (Direct PC and other) systems, whose connections work in the same manner.

Step 1: Set Up the Gateway

If you haven't already, network your computers using any of the methods showcased in the August 1999 *Maximum PC* feature, "Down-Home Networking." Once your LAN is up and running, select one computer to act as the gateway. The gateway computer must be able to run Windows 98 Second Edition, so it must at least meet that OS's minimum system requirements (486DX/66MHz, 24MB RAM, 205MB hard drive space).

In Windows 98 SE, ICS setup and activation are wizard driven. To activate the wizard, go to the Windows Setup tab of the Add/Remove Programs Control Panel and select Internet Connection Sharing from Internet Tools.

Next, install ICS. Have your Windows 98 Second Edition CD handy, and be prepared with a floppy disk onto which ICS can save an executable client configuration wizard.

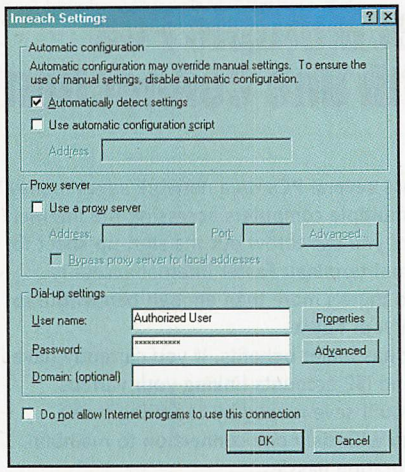


After installing Win98's ICS, you'll notice that several new Network components have been added to your system, and that a few preexisting components have been changed.

Since ICS uses your existing Dial-Up Networking settings, it can automatically make use of almost any Internet connection method you're employing, including a modem, ISDN, xDSL, or cable. ICS installation will automatically install all the necessary network components for your connection setup, including the Dial-Up Adapter, if it isn't already installed.

Step 2: Specify Connection Settings

Windows has never provided a way to specify a default connection in your Dial-Up Networking folder, but the browser check service introduced with the release of *Internet Explorer 4* performs this task. This component, which runs in the background at all times, uses the Internet Options Control Panel settings to provide some control over which ISP is automatically dialed when you activate an *IE*–enabled application. It also governs how often connection attempts will be made, and the duration of time between each connection attempt. ICS uses these settings to automatically connect to the Internet when a client machine makes a request.



Do not to mark the very last option, "Do not allow Internet program to use this connection," because it will keep Internet programs from activating your connection on demand.

If you're using multiple ISPs, set your preferred connection as the default by accessing the Connections tab of the Internet Option Control Panel, clicking on the Settings option, selecting Automatically Detect Settings, then entering the correct username and password for your preferred connection.

The browser-check service provides only limited connection-

WHAT TO LOOK FOR IN PROXY SOFTWARE

Because a proxy acts as your agent to the Internet, translating all outgoing and incoming requests, it's in a perfect position to cache frequently accessed information and graphics on your hard drive, resulting in up to 60% faster response times. While not all proxies include such a capability, a caching proxy with optimal settings and enough hard drive space can make a shared 56K connection feel like a mainline of pure Internet speed. A mid- to high-end software-based proxy would be your best choice, if web caching interests you.

Since it's the only machine directly connected to the Internet, a proxy can also serve as a barrier between your network and the outside world, or a firewall. When connecting a network to the Internet, security should be your primary concern. Choose a proxy that can configure itself as a firewall for your internal network. Most products act as a firewall right out-of-the-box, though some require additional configuration. Read the documentation that comes with your connection-sharing choice and implement the settings that will best protect your network.

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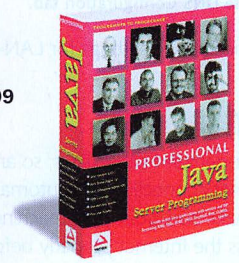

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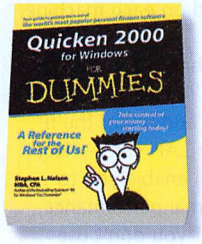

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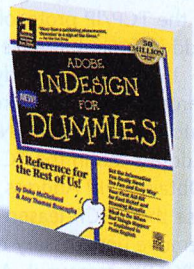

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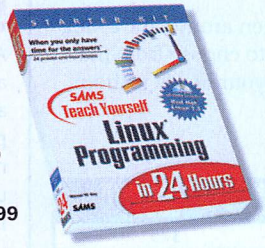

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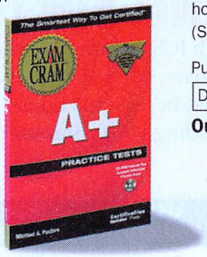

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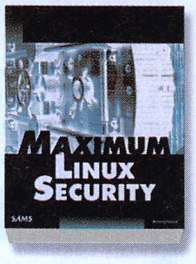

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behavior control; for example, a failed attempt to connect to the default connection doesn't result in an attempt to hit up the secondary ISP choices. When that first attempt fails, the system simply waits for divine intervention—or yours, whichever comes first.

Step 3: Choose An IP Pool

ICS defaults to a Class C address pool beginning at 192.168.0.1 and ending at 192.168.0.255 (hence, the 254-user limit), mainly because this IP address pool falls into a range of reserved, nonroutable IP addresses. Although the Internet community has reserved this address pool for private Class C networking, you can change ICS's default Class C pool to one of your choosing: Simply change the internal IP address listed in the TCP/IP (Home) properties of the host computer. But leave the subnet mask at 255.255.255.0; this allows you to keep an existing static IP address for your LAN if you've been using TCP/IP as one of your LAN protocols, while still allowing access through the host computer.

Step 4: Make Sure PCs Can TCP/IP

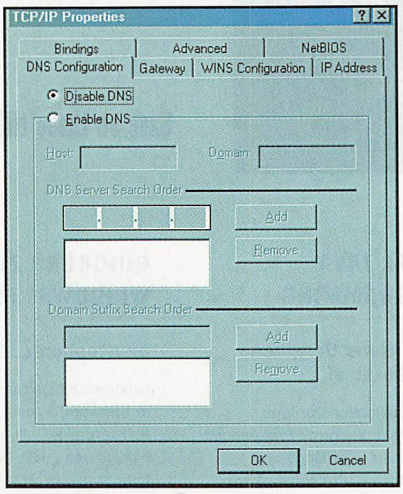
Since the ICS client configures just the browser, you must manually configure the TCP/IP settings on each client machine. If the TCP/IP protocol isn't currently installed on each machine, add it through the Network Control Panel.

If your LAN already speaks TCP/IP, it probably does so through static IP addresses. In this case, you'll need to venture into each machine's Network Control Panel, and under the IP Address tab in the TCP/IP properties of your LAN card, select Obtain an IP Address Automatically. This will enable you to use the DHCP-leased settings. Also, for optimal performance, remove unnecessary network components. If you don't use IPX/SPX, remove it. And feel free to ditch NetBEUI; to share files, you just need Microsoft's File and Printer Sharing Service. Reboot to implement the changes.

Manually entered settings always take priority over DHCP-leased information—keep this in mind, or you could inadvertently prevent Internet sharing on a client machine.

Step 6: Set Up the Client

After ICS is installed on the gateway PC and TCP/IP is installed on each client PC, it's time to configure the client PCs' browsers. To do this, run the Browser Connection Setup Wizard on each client machine, from the floppy disk that was created by the ICS installation program.



While you're under the hood, remove any existing gateways listed under the Gateway tab or DNS servers under the DNS Configuration tab.

The documentation for the client configuration program mentions compatibility with only *Internet Explorer 3* and up. For *IE 4* and *5*, simply enter the Internet Options Control Panel and select Automatically Detect Settings under the LAN Settings connection option. If you're partial to another browser, refer to its documentation in order to locate the specific settings for LAN-based Internet access.

Step 7: Test It

ICS includes dial-on-demand capabilities, so any client computer requesting an Internet connection will automatically activate the host connection. Make sure your host machine and all your client machines can access the Internet properly before inviting your friends and family over to view your handiwork. Use a client computer to activate ICS on the gateway computer, then view several web pages using both a web server's IP address and its URL. This will test for connectivity and verify that the DNS proxy can correctly convert a URL into its IP address. Also, check your e-mail, and play an online game or two to ensure that the other major TCP/IP protocols are being properly routed out to the net and back again.

Share It

As long as xDSL and cable proliferate and ISDN costs keep plummeting, there's no reason not to set up your own miniature ISP, giving everyone in your house enough bandwidth. You could wind up saving yourself the cost of redundant phone lines and ISP accounts, and the headache of placating disgruntled members of your household who've been waiting to get online.

MODEM SHARING SOFTWARE

Microsoft hardly broke ground with ICS—connection sharing software has been around for a long time. And if you're not a Windows user, you have plenty of software packages to choose from that are compatible with other OSes. Just be sure to choose a proxy that will serve your needs without breaking your pocketbook or exceeding your computer's capability.

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NAT32 6.4.5	9x/NT	Unlimited	No	No	Yes*	$47
IP Masquerading	Unix/Linux	Unlimited	Yes	—	—	—
iShare 3.5	NT/00	3* (32 max)	Yes	No	—	$129
SyGate 3.0	9x/NT/00	3*	No	Yes	Yes	$39
Win98 SE ICS	Win98 SE	254	No	Yes	Yes	—
WinGate Home 3.0	9x/NT	3*	No	Yes	Yes	$39
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WinProxy Lite	9x/NT	3	Yes	Yes	—	$59
WinProxy Unlimited	9x/NT	Unlimited	Yes	Yes	—	$299

*User limitation can be increased, but price increases accordingly.
Note: "—" signifies that particular function is left up to (or already included with) the operating system.

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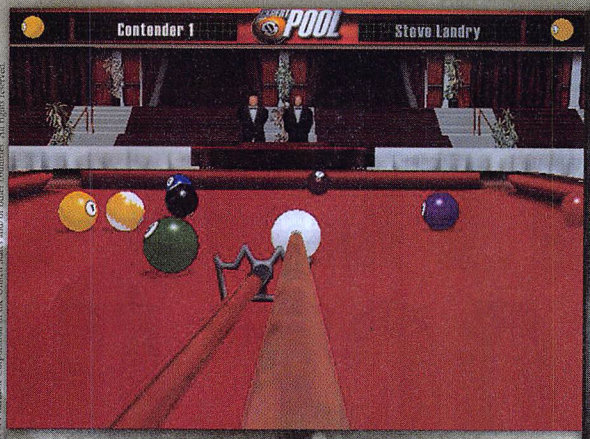

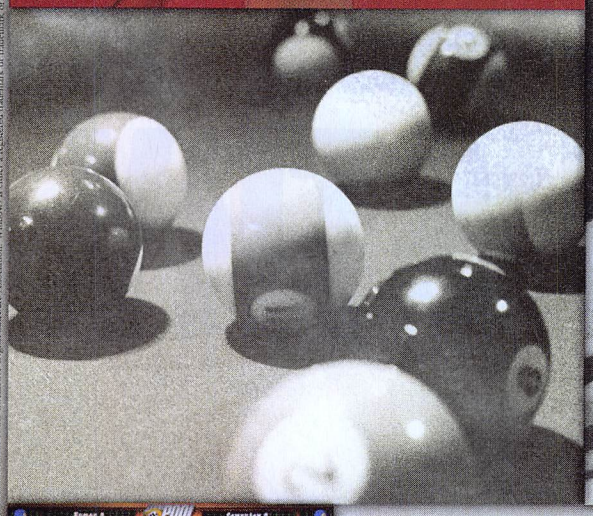

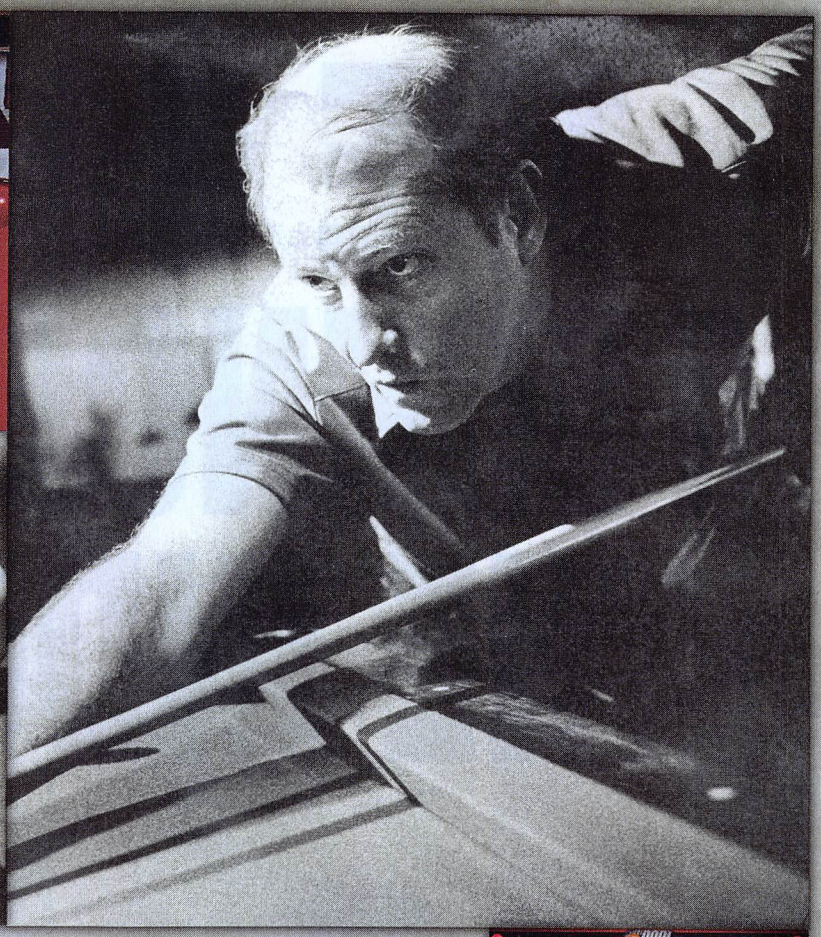

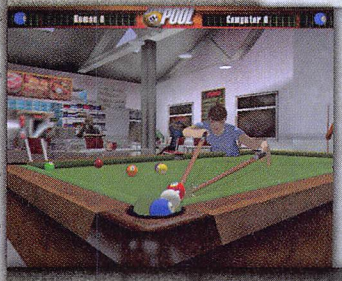

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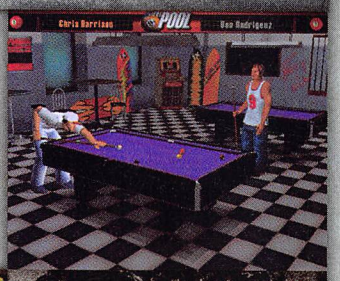

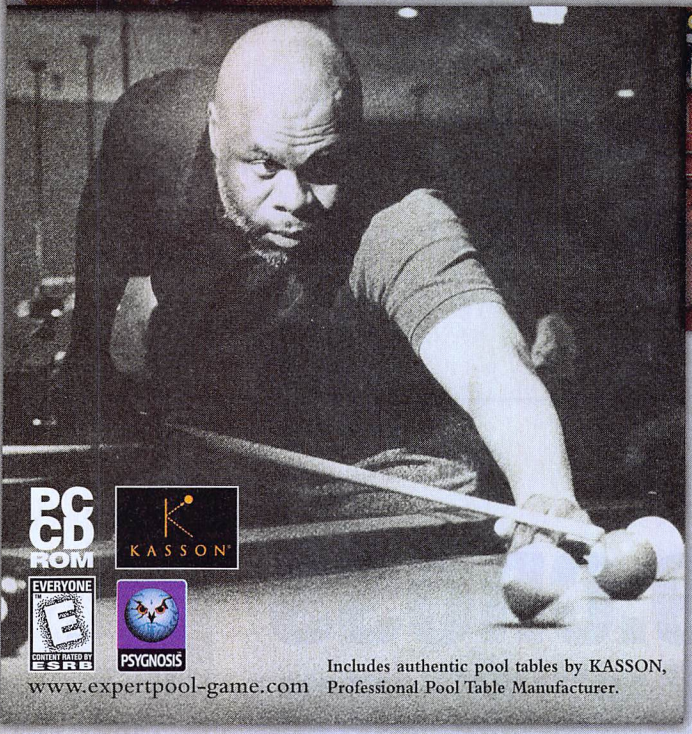

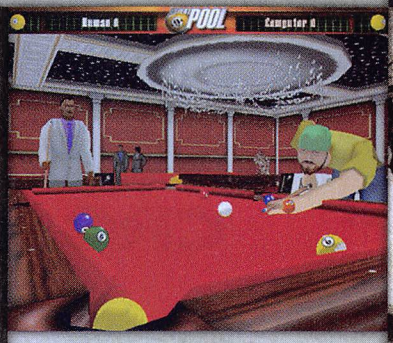

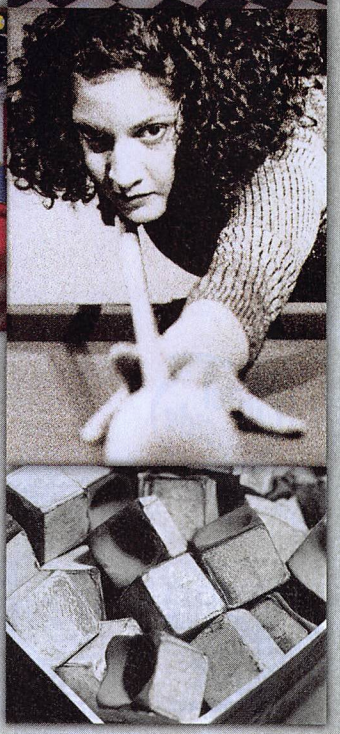

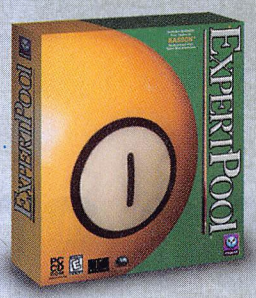

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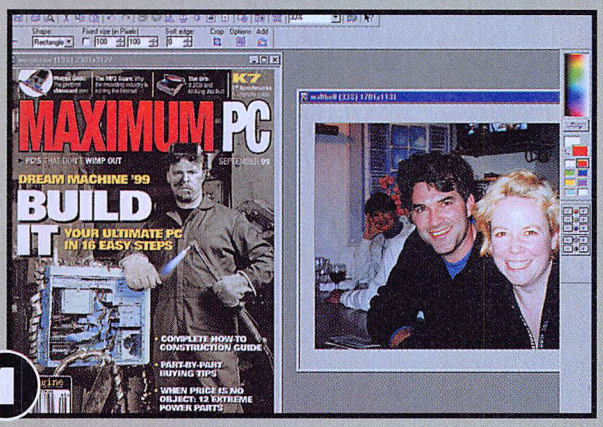
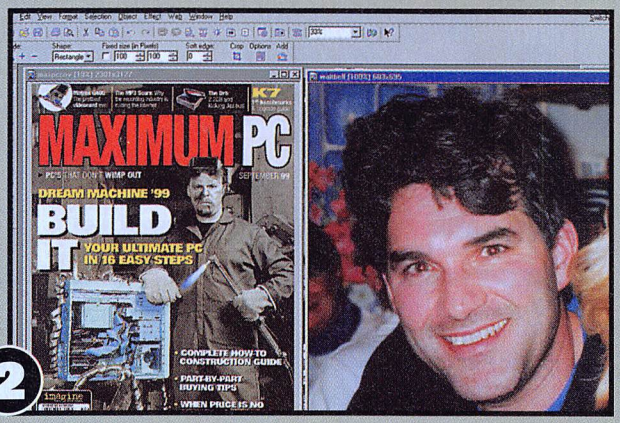


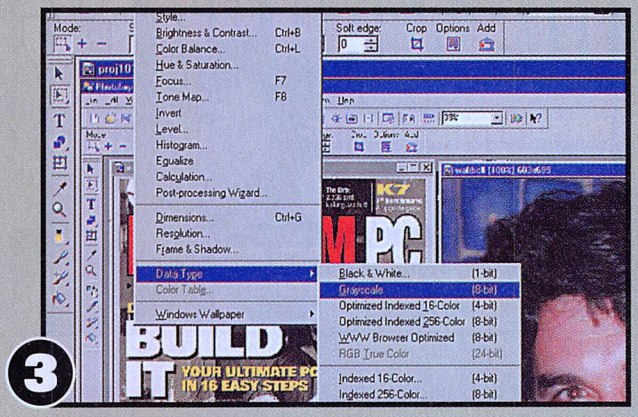
1

First, scan, straighten, and crop your images as needed. On the left is the September cover of *Maximum PC*. On the right is a picture of a friend that we'll put on the cover (we chose a head-shot that won't need a lot of tender manipulation).



2

Crop the photograph down even further so that only the head and shoulders are showing.

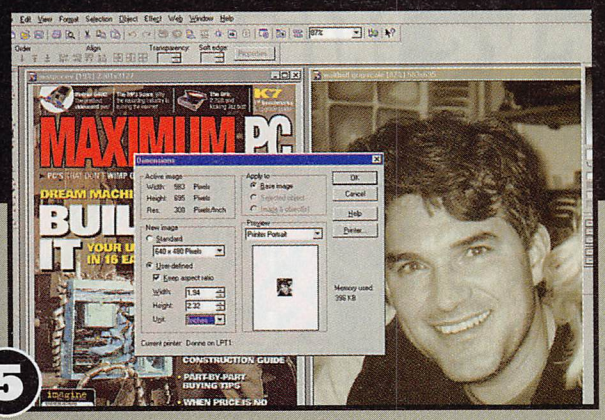


3

You'll notice that the face on the magazine cover is in sepiatone, while the photograph is in color. To fix this, go under Format/Type/Grayscale, and convert the file to grayscale.

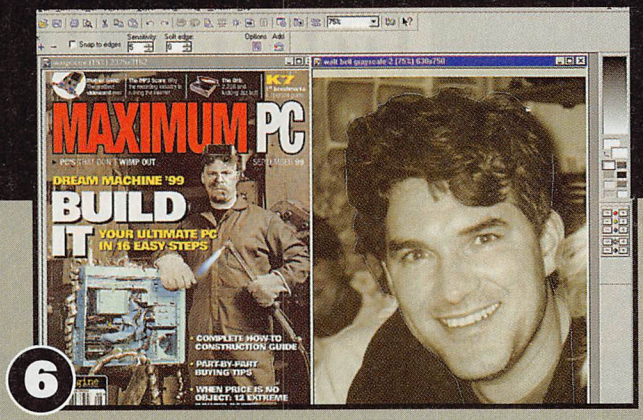
4

After converting the image to grayscale, you'll want to convert it to sepiatone so it better matches the magazine. This is done by going to Color Balance, setting the variation to 10, and choosing the sepia-colored reference image in the upper right-hand corner.



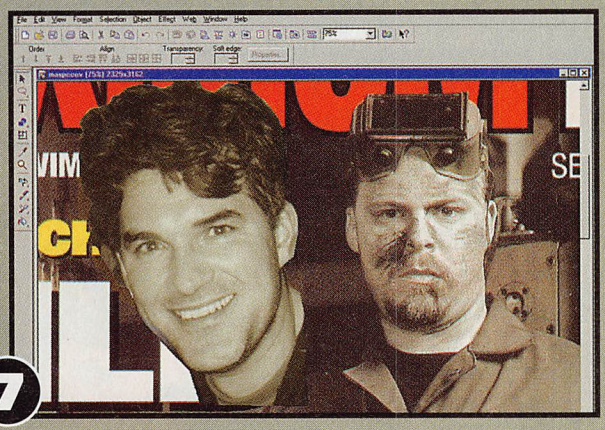
5

To make sure that your face will fit on the cover, resize the image as needed. Select Format, then Dimensions. To get the size in inches, select "Inches" from the Unit pop-up menu. The face should be between 2- and 2.5-inches in height in order to fit.



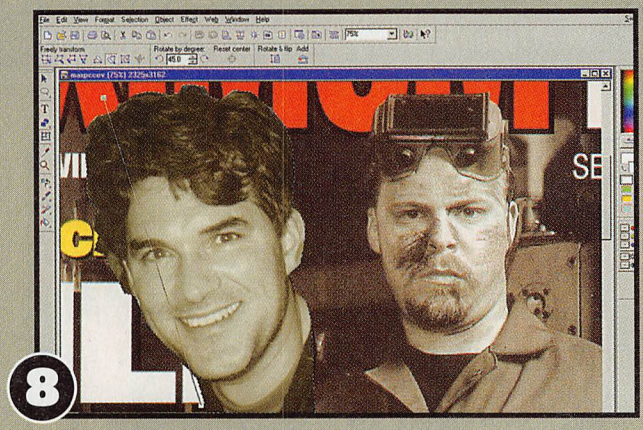
6

Use the Lasso Tool to define which pixels of the head should be selected for transfer to the magazine cover. Carefully draw around the head's outline, being especially careful around the hair and chin—screw up and you'll have to start from scratch.



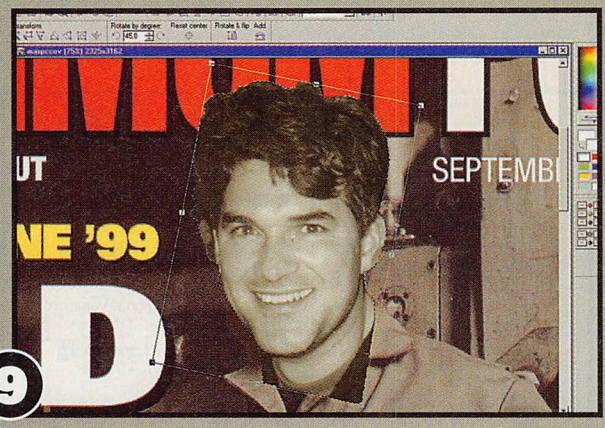
7

Now, copy this selection and paste it onto the image of the magazine cover. You can now close the scan of your photograph.



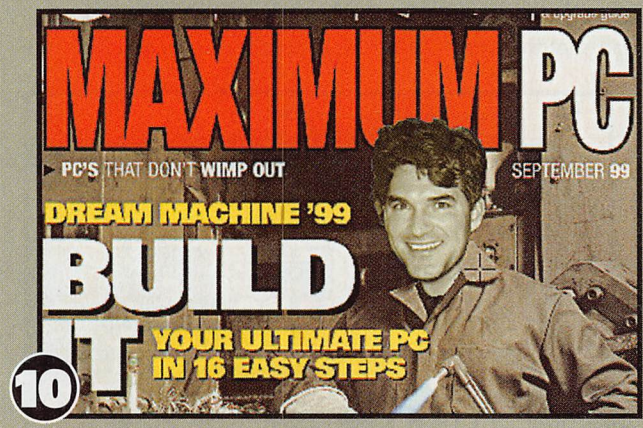
8

Chances are, the face from the photo you scanned does not fit perfectly. To make it look better, use the Transform Tool to orient it correctly. Here, we use the vertical Rotate handle to correctly orient the tilted head. Move the handle until the head is in the correct place, then double-click.



9

If it still doesn't fit correctly, you may need to use the Transform Tool again to make your head slightly larger or smaller. In this case, we use the Transform Tool's Resize attribute, which is the left-most icon on the top. When you resize, be sure to hold down Shift. This will keep the aspect ratio of the image the same, and keep the face from looking distorted.



10

Now it's time to clean bad pixel segues between your base image and head. First, click on Object/Merge to unite the base image and the face, then use the Clone tool to clean up edges. Simply shift-click an area that you want to grab a color reference from, then paint that color on the image as appropriate. Voila, you're a cover model—just like Ricky Martin!

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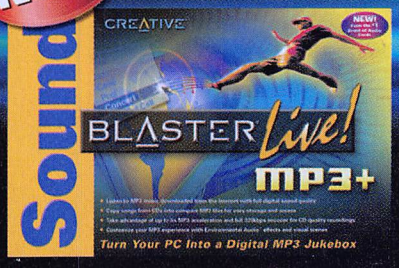

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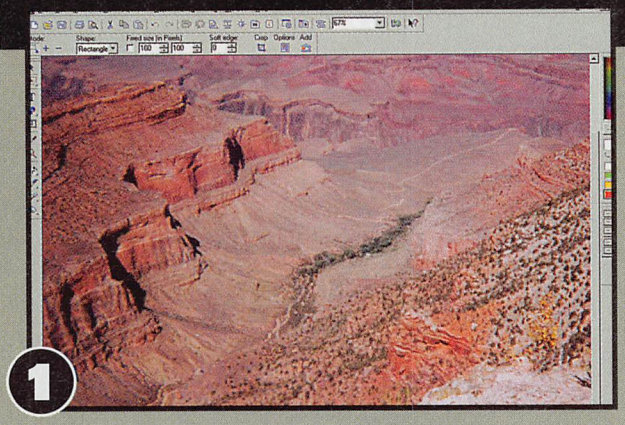
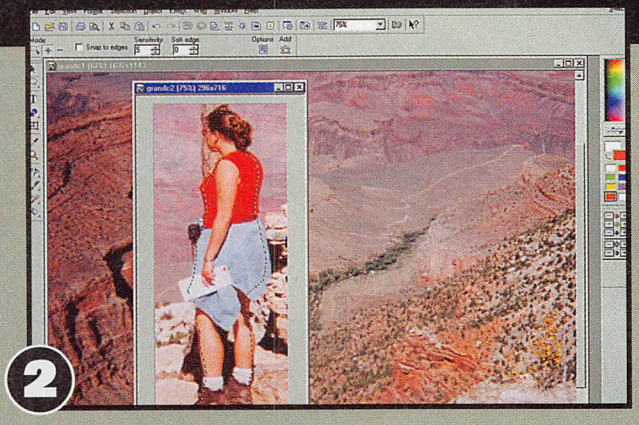
Visit the Grand Canyon (or just pretend you did)

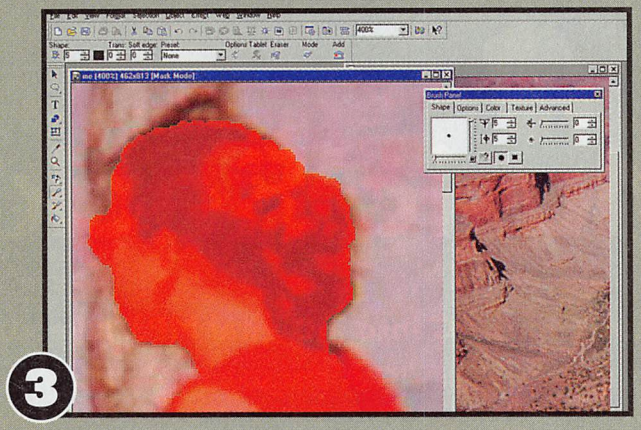
By combining an image of yourself with a scene from the great outdoors, you can convince anyone that you've had the vacation of a lifetime.



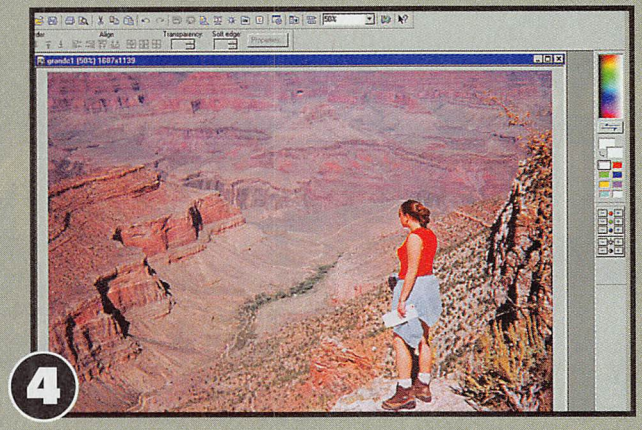
The first step is to select, scan, and correct the picture you want to use. This image was taken from the South Rim of the Grand Canyon.



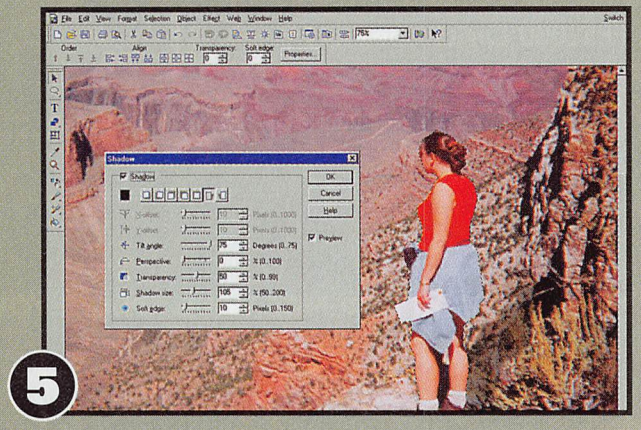
Next, prepare a picture of yourself in an appropriate pose. Use the Lasso tool, and make a rough selection of your image. Outline inside your image, rather than outside.



Click the Mask Mode icon; everything but your selection will turn red. Now, select a fine paint brush with a transparency of 0, click on Format/Invert to make your image red, and use the Paint Tool to select every pixel of your figure that you want to keep.



Exit Mask mode, and copy and paste your figure into the Grand Canyon. Your figure is now an object on top of the background. Move it around until you are happy with the placement. Watch your step—we need not remind you the fate of Wile E. Coyote.



To add a realistic drop shadow, right-click on your figure and select Shadows. The customization selections we use here help make the image match the shadows on the left side of the background image.

To make the figure better match the landscape, we lowered the figure's brightness/contrast settings to be more in line with the muted background. In another adjustment, we lowered saturation to bring down the intensity of the red shirt.

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The Queen, by **Martin Murphy** ©1999

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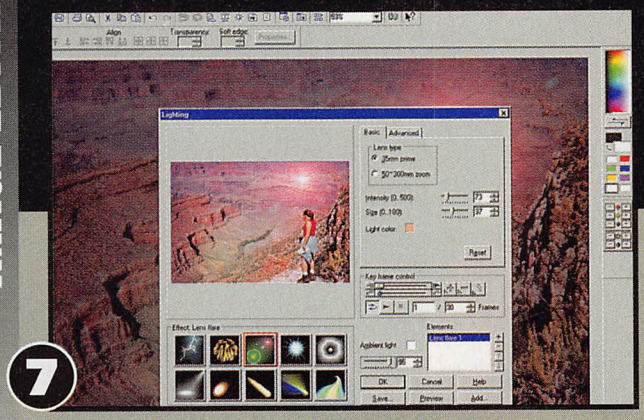
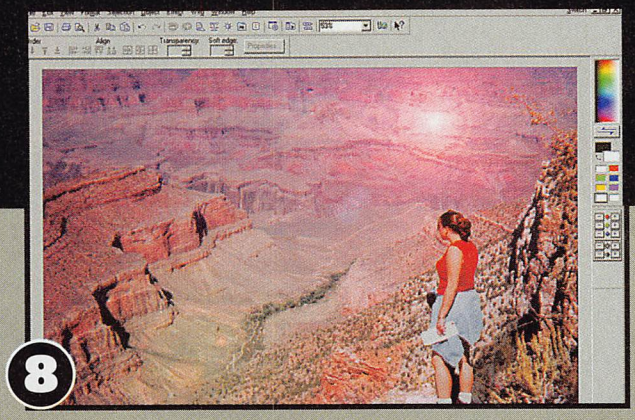


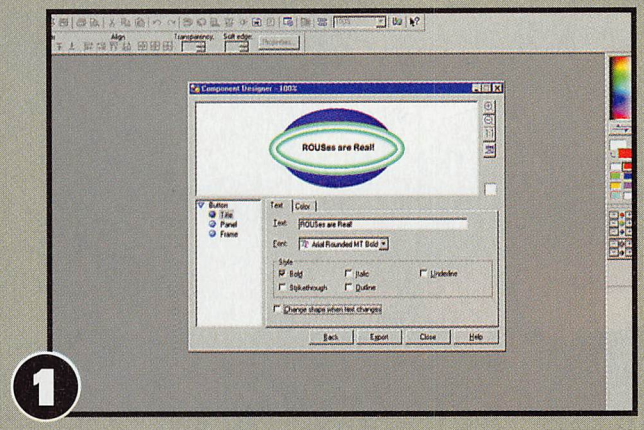
A lens flare might help demonstrate the Grand Canyon's extreme heat. To make the flare affect both the figure and the background, select Object/Merge All. You'll find the Lens Flare under Effect/Creative/Lighting. Tweak the effect as necessary.



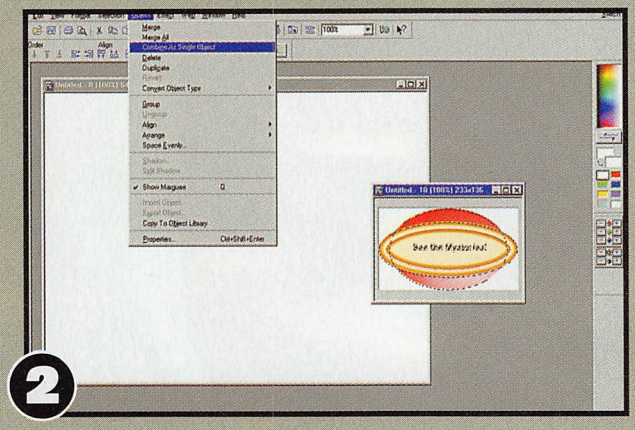
Here's the final image. It's always best to use subtle shadow and lighting effects when you're trying to produce a credible photographic alibi.

Create Java Rollover Buttons Almost Instantly

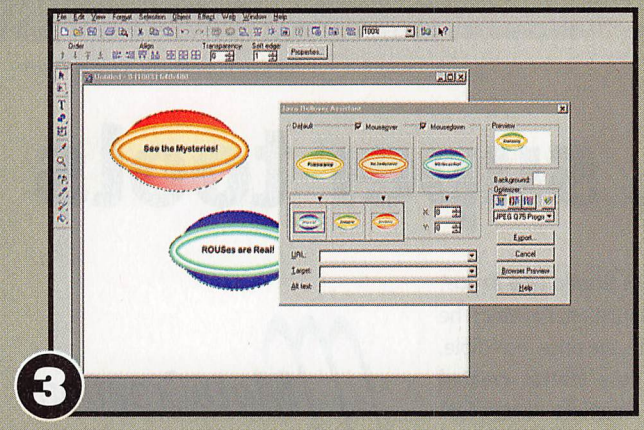
PhotoImpact's Java Rollover Assistant makes it easy to create three-frame rollover buttons for your web site. To make this project even easier, start with the Button Designer or the Component Designer, both found under the Web menu.



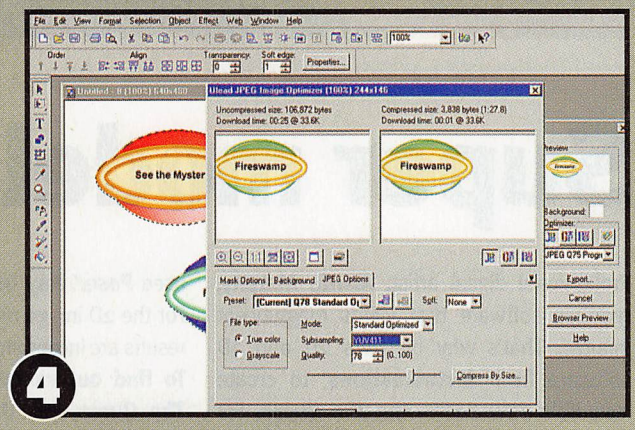
To make the rollover frames, select Web/Component Designer, choose a button shape, and follow the Wizard to add text and color to each frame as appropriate (when all three frames are merged together, you'll have your rollover animation).



Now, export each button to *PhotoImpact* format, and combine all three into a single object by using the Pick Tool and Shift-clicking on each element. The "marching ants" will appear around each element. Now, select Combine As Single Object.

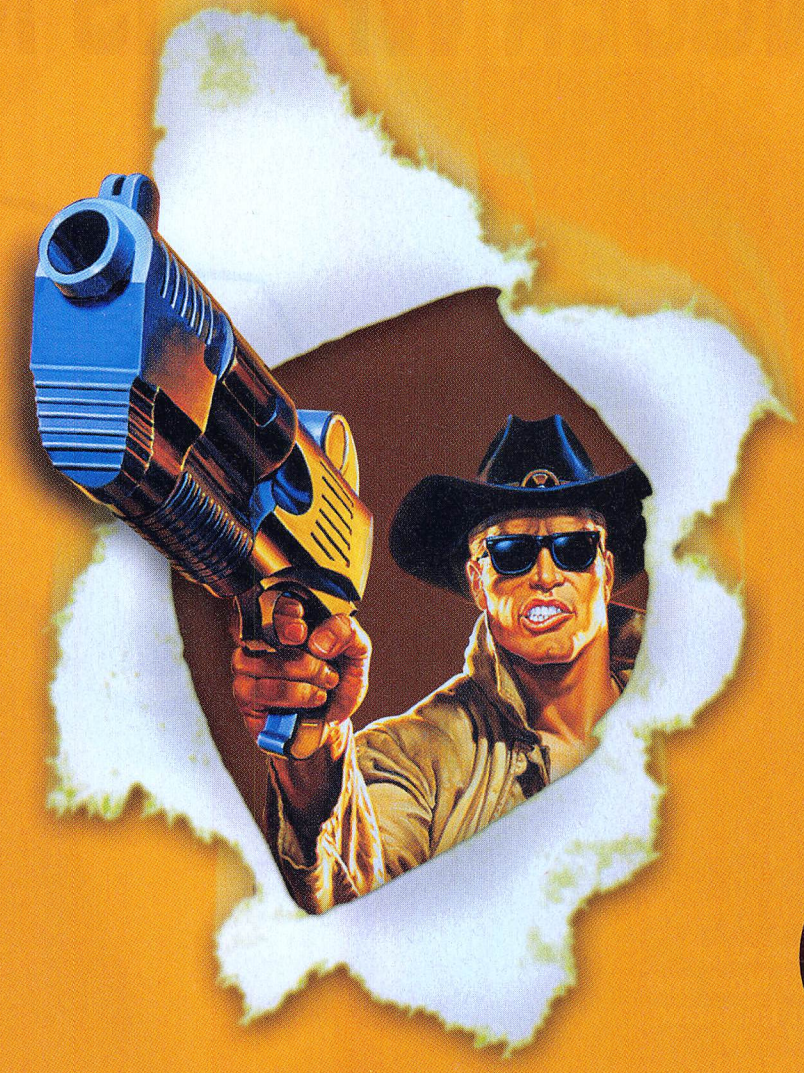


Copy and paste each button to an empty window. Now, select all three by drawing a box around them after selecting the Pick tool. Select Web/Java Rollover Assistant to bring up the dialog box shown here. Select the right buttons from the pop-up menu.



Next, insert the URL for the button's link and alternate text. Now, export and save. You can modify and check the image quality of the button using *PhotoImpact*'s Image Optimizer. You now have a web-page button that flips out during mouseovers!

In real life, Duke Nukem would be forced to attend 'sensitivity training'.



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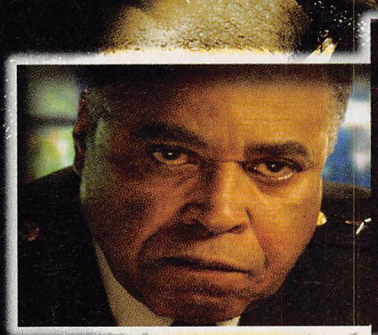

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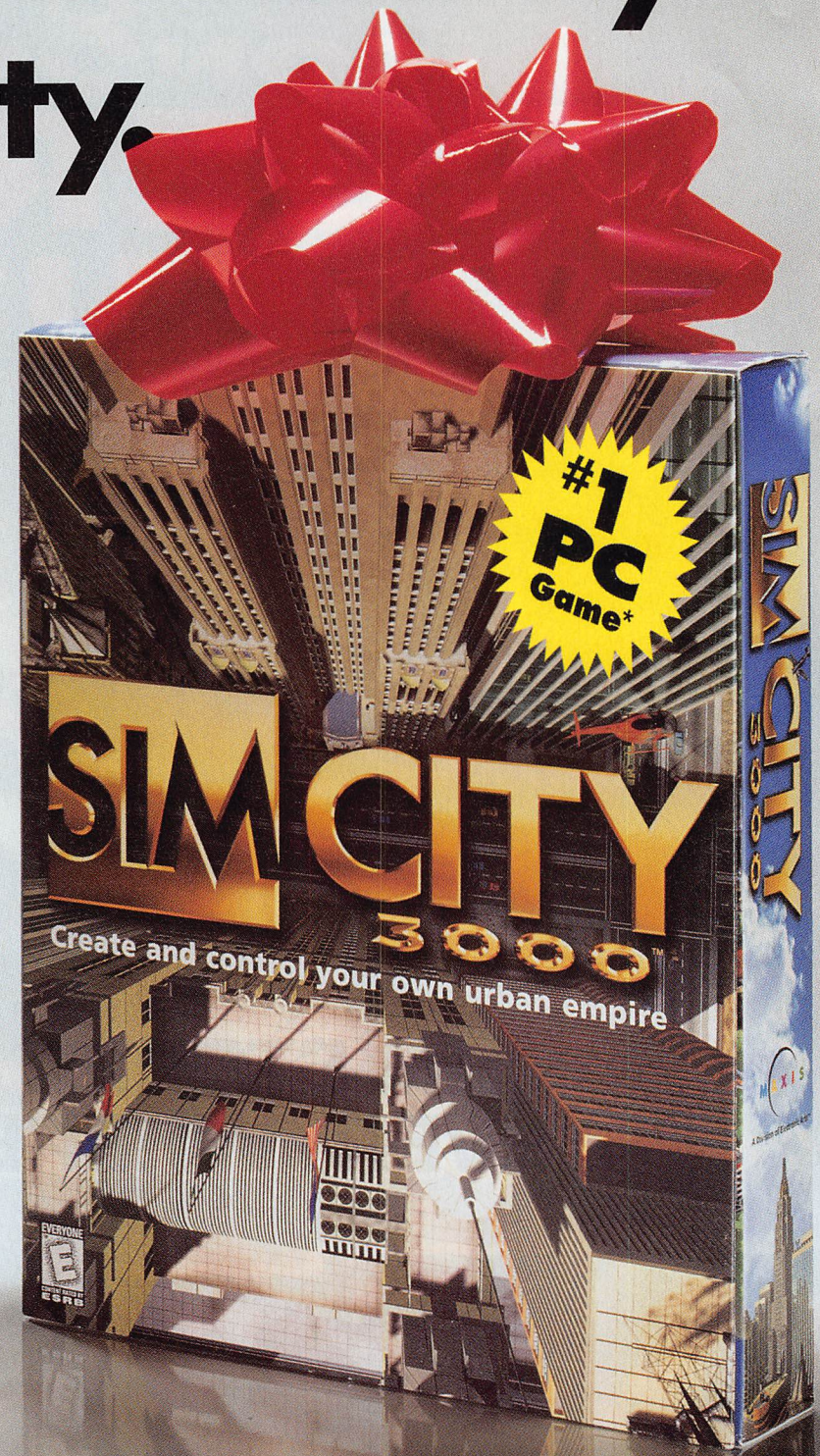

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PC Mac EVERYONE E CONTENT RATED BY ESRB

Learn to Speak 3D

How much do you benefit from a graphics card with a complete set of 3D features? Can a z-buffer cure insomnia? Can you find your way to San Jose with an environment map or a mip map? How much bilinear filtering will make water drinkable? Will excessive bump-mapping lead to hairy palms?

The 3D terminology that graphics-card makers liberally toss around isn't part of some bizarre dialect. Get in the know: Learn the terms that populate videocard spec sheets. Know whether features such as anisotropic filtering, multitexturing, and bump-mapping are actually important to you, and which 3D features and effects have the most impact on the Direct3D and OpenGL games you play. Besides being able to spot a visual treat in action, you can leverage your 3D vocabulary to make smart upgrading decisions in the future.

From alpha-blending to z-buffer, here's the lowdown on what each term means and how it looks in a game. We also provide a handy pronunciation guide and show you how to use each word in a sentence, so you can immediately drop hip 3D lingo into your everyday conversations. While others look at a game and say, "Check out the pretty explosions," you'll exclaim, "Dig the kick-ass alpha-blending and particle effects in this multitextured Direct3D gore-fest."

—Sean Downey

texture-mapping /teks TYUR MAP ing/: Applying a bitmapped image to the surface of a polygon surface.

A texture map is a single bitmap image that is applied to the face of a polygon. Texture-mapping puts Tiger Wood's face on the polygon golfer on your screen. Just about every 3D game stocking the shelves of your local computer store uses texture-mapping, and considering the payoff in detail, it's easy to see why. Getting the same kind of detail from a non-texture-mapped model means seriously cranking up the polygon count, and the resulting heavier geometry requirements will seriously bog down the scene. By supplying the necessary details with a texture map, a game can use lower polygon counts, which directly translates into higher framerates.

The visage of ball-masher Mark McGwire was mapped over the polygon cranium of a standard model in Baseball 2000.

The big trick with texture mapping is to maintain the proper texture perspective after the image has been mapped onto a surface. Perspective-correction techniques are used in most texture-mapping operations to do away with the depth distortions inherent in applying a 2D image to a 3D object. Perspective corretion continuously translates the texels of the mapped image into pixels that match the spatial orientation of the surface, allowing the texture map to rotate so it matches the angle of the polygon.

Texture-mapping has been around for awhile, but it still has a few tricks up its sleeve. Imagine the possibilities of mapping video snippets and 3D textures onto polygon surfaces, and you can see where the next texture-mapping innovations are coming from. You'll see more games in the near future that use these advanced texturing techniques.

"In order to hide the damage done to the wall during the party, we texture-mapped a nice daisy print over it."

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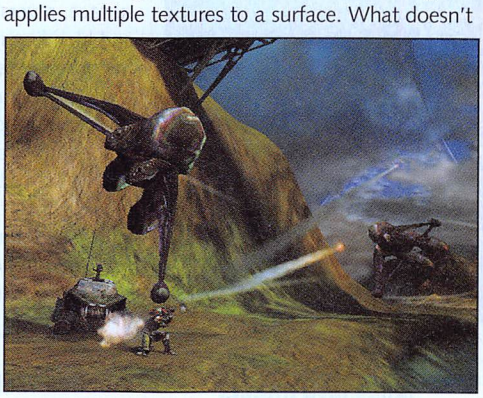
multitexturing /muhl tie TEKS tuhring/: Applying several effects to a surface and blending them, creating special effects that appear as advanced surface details.

Since texture mapping applies a single texture to a surface, it logically follows that multitexturing applies multiple textures to a surface. What doesn't



To achieve its lush details, Bungie's Halo uses four textures mapped to a single surface.

Your personal tech briefing on the concepts and components that comprise the PC experience.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

necessarily follow is the versatility that multitexturing lends to the application of texture layers. Not only can it increase surface detail by mapping additional textures over the original texture map, but it can also be used to lay down layers that modify existing textures with bump effects and lightsourcing.

Multitexturing's popularity in the current generation of 3D games is largely due to the big payoff it delivers. Realtime lighting effects don't deliver enough bang to justify their intense processing needs; multitexturing allows the effects to be handled by lightmaps, which achieve the same result, without the performace penalities, by storing pre-rendered lighting effects and an engine that applies them to the right textures at the right times. Lightmaps determine how a texture will look as the light source shining on it changes position.

Since most graphics cards sport multiple processing pipelines, they can execute two multitexturing effects in a single pass by using one pipeline to digest each texture layer. Look for the arrival of quad-texturing graphics cards this winter.

"Mike's multitextured personality rubs me the wrong way—is he a tool or what?"

---

bump-mapping /BUMP MAP ing/: Creating the illusion of variations in surface depth by mapping an additional bump layer to a surface or texture.

Bump mapping adds tactile details, such as the dimples on a golf ball, the ridges on a potato chip, or the scratched paint on a bumper, to the surface of a rendered object. Bump-mapped surfaces are especially awesome because they realistically interact with the lighting that falls across them, casting different shadows and reflecting different bumped details that shift according to each light's movement and placement. Largely enabled by multitexturing, bump-mapping requires the rendering engine to make several passes in order create the realistic appearance of surface depth.

Currently, there are two hardware bump-mapping techniques—environment-mapped bump-mapping and dot-product bump-mapping—and one simulated bump-mapping effect, embossing, that's accomplished through alpha-blending tricks. Embossing doesn't use an actual bump map; instead a duplicate layer of the original surface is shifted to create an alpha channel lightmap containing the shadows and lights of the simulated bumps. This lightmap is blended with the original surface to give the illusion of bumped details. Any card that supports multitexturing and alpha-blending can do embossing.

Dungeon Keeper's fancy lava effects are courtesy of environment-mapped bump-mapping.

Both dot-product and environment-mapped bump-mapping work their mojo by laying down bump maps, which contain height information for each texel of the surface that's being bumped. The main difference between the two bump-mapping techniques lies in the way they calculate lighting using the bump map's height info: Environment-mapped bump-mapping does it on a per pixel basis and dot-product bump-mapping does it on a per vertex basis. This means that dot-product bump-mapping doesn't look quite as authentic as environment-mapped bump-mapping. Videologic's PowerVR Series 2, nVidia's GeForce 256, and 3Dlabs' Permedia3 support dot-product bump-mapping, and environment-mapped bump-mapping can be found only on Matrox's G400.

"Edgar sees the dermatologist for his bump-mapped complexion."

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environment mapping /in VIE ruhn ment MAP ing/: Applying a reflection of the surrounding environment to a 3D object.

Although a seemingly simple process, well-rendered realtime environment mapping requires a lot of horsepower. The payoffs are accurate reflections and lighting effects that add realism to glass, liquid, and metallic surfaces. Environment mapping entails determining what image is in the "sight line" of a 3D object's reflective surface, reversing the image, and blending it with the texture-mapped surface. This is done by surrounding the 3D object with a projective map that contains a reflected version of what's seen at each point on the object. Then, the reflection and lighting effects are applied on a per-pixel basis to the surface of the 3D object, and constantly updated with new information from the environment map.

In Expendable, the sky is environment mapped onto the water's surface.

"The kitchen was so clean, I saw my reflection environment-mapped in the floor."

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z-buffer /ZEE BUH fur/: Area of the local graphics card's memory that tracks the depth position of each pixel in a scene.

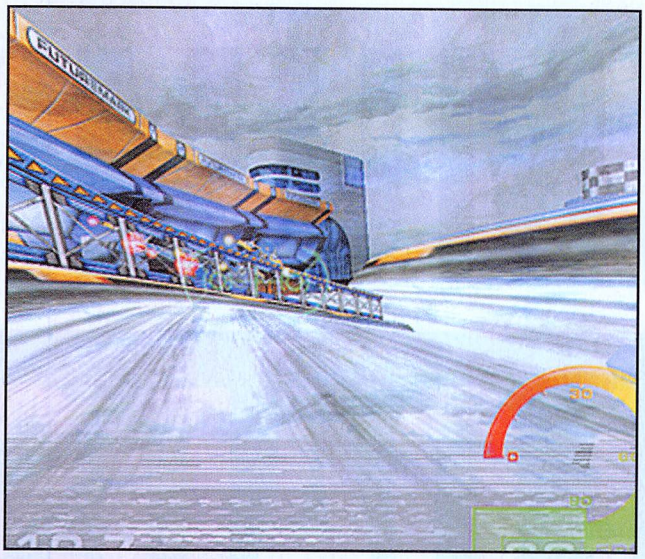
The z-buffer ensures that all the polygons are in their proper places, keeping the backside of a 3D model to the back and the

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

frontside to the front. Improper z-buffering leads to poke-through anomalies (objects penetrating one another) and flickering (3D objects dropping in and out of existence).

When the models in a 3D scene are fed through the rendering pipeline, the coordinates that place them in 3D space are converted into x and y points that correspond to on-screen pixels. Since displays are 2D-only, the z-values are fed to a z-buffer, which keeps track of the depth of each rendered pixel. The graphic processor compares the z-buffer's depth values with incoming pixels to determine whether they need to be drawn. If a pixel that needs to be rendered lies hidden behind another object, it doesn't make it to your screen and the graphics processor is saved the trouble of rendering it.

A graphics processor's rendering accuracy depends on how many bits per pixel the z-buffer can handle. A 16-bit z-buffer can handle 65 thousand different possible depth positions; a 24-bit z-buffer does 16.7 million, and a 32-bit z-buffer can track 4.3 billion possible points in the distance—for the most complex outdoor environments imaginable.



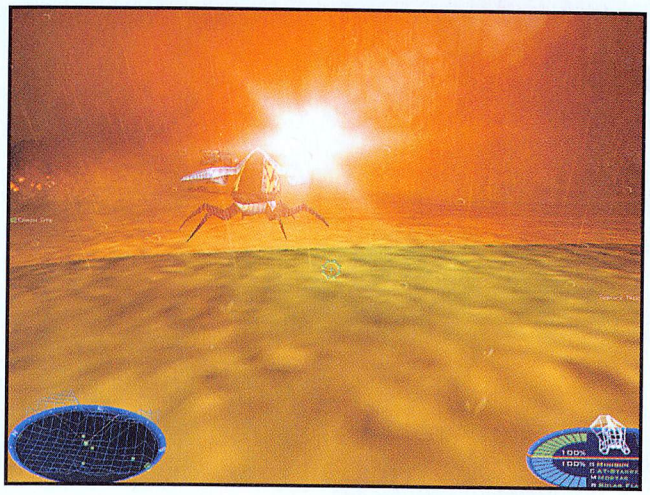
Inadequate z-buffering results in bad visual glitches and image flickering, such as in this 3DMark 99 Max benchmark.

"They met by chance in the z-buffer, and even though Paul and Janie developed a deep spatial relationship, she was always in his shadow."

---

alpha blending /AL fuh BLEND ing/: Creating translucent or transparent image layers, and combining them to generate advanced lighting, transparency, and particle effects.

The "alpha" refers to the alpha bit used to set each pixel's transparency level. Since 32-bit color is actually 24-bits of color data combined with an 8-bit alpha channel, it allows 256 degrees of transparency (or eight alpha layers), as opposed to the 2-to-16 degrees of transparency available in 16-bit color's alpha channel. On the whole, alpha-blended effects are greatly enhanced by the extra alpha-channel information, which allows smoother transitions between the alpha layers and the background images. By transitions, we're referring to the way alpha layers are blended together in the frame buffer: The color values of the pixels are combined in the alpha layer with the colors that lie behind the alpha layer, resulting in the proper transparent effect.



Battlezone II's alpha-blended missile trail and explosion effects cast the familiar glow of violence across alien landscapes.

Alpha blending is used to create visual effects such as lens flares, transparent water, clouds, and translucent smoke. When it's done properly, alpha blending creates soft fades between the special effect and the background scenery. If you've ever seen the glowing coronas surrounding the bright lights that populate 3D games, you know what alpha blending looks like.

"Alpha-blended transparencies and state-of-the-art animation help little kids to forget that Casper the Friendly Ghost is actually a dead little boy."

---

fogging /FAH ging/: Masking objects in order to give the illusion of distance or atmospheric conditions.

Fogging is a fancy alpha-blending effect that blends the pixels of a translucent fog layer with the objects that lie in the distance. Just like real fog, 3D-fogging effects make objects and terrain disappear into a distant haze. While this can be used to simulate fog or smoke, it's also useful for making

Fogging creates the illusion of depth, and can also be used to hide the back side of a clipping plane.

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things seem very far away. The depth information used to blend fogging effects is derived from the z-buffer, which tracks each object's depth within a scene. The further out an object is, the more intense the fogging.

"The students were in a fog by the end of Professor Vogler's lecture, since the topic was completely obscured by linguistic alpha-blending."

---

anti-aliasing /AN tee AY lee uh sing/: Any process that reduces or smoothes the stair-stepping visual effect that plagues the edges of rendered scenes and bitmaps.

At some point, all the detailed image data that's chugging down the 3D pipeline must be mashed together and sent out to your screen. The technical term for this mashing process is sampling. Jaggy lines are the byproduct of sampling the huge amounts of data that make up a 3D scene.

To alleviate this problem, several anti-aliasing techniques can be used to increase the sample rate and store more of the original image data. Edge anti-aliasing tracks potentially unsightly polygon edges, then blurs the edges with a filter after the frame is drawn. Downsampling anti-aliasing renders the entire scene at a higher resolution, then scales it down for output. Both techniques are dog-ass slow.

Edge anti-aliasing cleans up the jaggies in games such as Rollcage.

3dfx is looking to change all that by the end of this year with its T-buffer technology. A T-buffer is a fancy accumulation buffer that holds multiple image renderings and combines them to create nifty digital effects. The T-buffer differs from old-school accumulation buffers in that it's able to render discrete portions of a given scene, rather than pumping out an entire screen every time an image needs to be updated. It's an ideal tool to accelerate full-screen anti-aliasing because it can crank out extra image samples without incurring the kind of performance penalties inherent in the traditional accumulation-buffer architecture.

"Lorraine swears by Lancôme's new anti-aliasing lotion; it removes the age spots and jagged lines that weigh down her face."

mip-mapping /MIP MAP ing/: Swapping textures of different sizes and details on a single surface as it moves closer or farther away.

Mip-mapping makes objects moving away from you appear in the proper perspective by speeding up rendering and improving the image quality of texture-mapped polygons. It works by taking a high-resolution texture (say, 512x512) and creating multiple copies of it (at 64x64, 32x32, and 16x16). As the texture-mapped object moves deeper into a scene, the level of detail drops and lower-resolution texture maps are mapped to the object as it gets smaller and smaller. Without mip maps, the renderer must crunch down the original texture to fit it on the smaller object, which slows framerates and results in aliased textures.

There's rarely a one-to-one correspondence between the texels in a mip map and the pixels mapped to polygons. When a mip map texture is scaled up or down to fit a smaller or larger surface, the resulting image looks blocky and misshapen. To avoid unsightly mapping errors, developers use filtering techniques such as bilinear, trilinear, and anisotropic filtering in the mip-mapping process, to interpolate the final value of each texel based on its surroundings.

Bilinear filtering uses the color values of the four surrounding texels on a single texture map to calculate the final pixel value. The resulting effect is the most visually blurry of the filtering techniques, and does nothing to address the texture shimmering that occurs when one texture replaces another. Trilinear filtering takes care of these visual deficiencies by sampling the four surrounding texels of the two nearest mip maps, resulting in a sharper image that flows more gracefully up and down the detail ladder. However, trilinear filtering requires eight memory reads per pixel, compared to four for bilinear filtering.

Bilinear and trilinear mip-mapping don't take into account how a texture can be distorted when it's mapped to a surface that doesn't squarely face the viewer. Angled surfaces elongate pixel details and result in textures that are blurry on one side and sharp on the other. Anisotropic filtering takes samples from even more texels in the surrounding mip maps, but chooses them according to a projection of how the final map will lie. This results in sharper texture details that don't distort as a 3D model rotates.

You can usually spot a bilinear-filtered mip map; in this Quake III shot, it's in the middle of the bridge.

"In Austin Powers: The Spy Who Shagged Me, Mini-Me is an anisotropically filtered mip map of Dr. Evil."

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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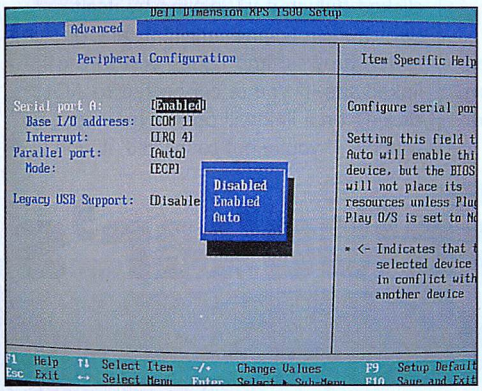
ASK THE DOCTOR

The Phantom of the OS

I'm having problems with my new Zoltrix Phantom 56K PCI internal WinModem. I don't think it's a hardware problem, because when I installed the modem, Windows detected a PCI Communication



Disable onboard COM ports through your BIOS.

device like it was supposed to, and installed the drivers from the Zoltrix CD. But I can't install the modem on any of my existing COM ports; my Device Manager shows COM ports 1 and 2 as open, but it won't let me assign the modem to them.

I'm also wondering why my connection speeds always differ when I actually get the modem to connect. The modem's top possible speed is 46,666bps, and its lowest speed is 33,600. On my Pentium II 333MHz machine with 32MB, it achieves these speeds. But when I tried it on my father's computer (yes, I'm a 14-year-old kid), a Pentium 60 Packard Bell with 16MB, its top speed was only 21,666bps. I went into the modem properties, where it says the top baud rate is 115200, and checked the box that says "Always connect at this speed." The connection is really fast then, but after the modem bleeps and whizzes, the connection freezes.

—Gerrit Carinus
Ceres, South Africa

Let's deal with the COM port problem first. Go into your BIOS (usually done by hitting the F2 key while your system is booting up) and disable the COM ports you're not using. If you're using a PS/2 or "round connector" mouse and you're not running anything else on the COM 1 or COM 2 ports, disable both COM ports. Once you've done this, remove your modem from the Device Manager and reboot your machine. Windows should recognize your modem and assign it to one of the free COM ports.

Your connection speeds vary because when you dial into your ISP, you're not dialing into a single modem, but to a rack of them. No modem manufacturer guarantees consistent connection speeds because it just doesn't happen. The modem brand that your ISP uses and the modem brand that you use also affect your connection speed—some ISPs actually recommend that their customers use a particular modem for optimum performance.

Check whether you're using a Host Signal Processing (HSP) modem. HSP modems rely on your system's CPU to handle signal processing. This can be a heavy burden on the CPU, so HSP modems aren't recommended for intense tasks such as online gaming—people who do use HSP's for online gaming are typically referred to as HPBs, or High Ping Bastards. For some good tips and tricks on optimizing your connection, refer to the 12-Step in the July 1999 issue of *Maximum PC*.

Floppy Love

Does Windows 95/98 have some weird attachment to the 3.5-inch floppy drive? I personally think that the drive is ugly and useless, but Windows doesn't agree. After physically unplugging the drive and removing it from my PC's BIOS, Windows still believes the drive is there. It reports an A: drive in Explorer, and even worse, it says that the drive is using DOS compatibility mode. Is there any way to remove every trace of the floppy drive from my computer?

—Trung Ma

> **People who use HSP's for online gaming are typically referred to as HPBs, or High Ping Bastards.**

Windows' marriage to the floppy is well known, but the motherboard is just as much at fault as Windows. Older motherboard manufacturers never imagined a world without floppies, but with the advent of CD burners, Zips, and Superdisks, some are starting to see the light. Many newer motherboards, such as Soyo's SY-6BA+III, allow the floppy to be disabled through a BIOS setting entitled "Report no FDD for Win 95/98." To find out

This month:

- Take my modem, please
- I sing the speakers electric
- Why Windows loves your floppy
- SPP, EPP, FYI ASAP
- Mother, may I overclock?

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if a motherboard's BIOS supports this option, visit the manufacturer's web site and check out the manual for the board.

Snap, Crackle, Pop

I recently purchased a Cambridge SoundWorks speaker and subwoofer set for my new Alienware computer system. I have it plugged into my surge protector, but every time someone in our house turns off an electrical appliance, I get a static discharge crackle through my speakers. Is there some way to alleviate this problem?

—Jason Siebert

Your problem may not lie with your speakers, but within the electrical lines or other electrical devices in your house. As a test, try running the speakers from a battery source. If the crackling still occurs, the speakers themselves may be defective. If the crackling goes away and your computer speakers typically run on the same circuit as a host of other appliances, the annoying sound is most likely caused by the varying current flowing through the circuits. All you can do about this is ensure that your PC and its speakers are pulling power from the same circuit, and move other products in your house (such as TVs and refrigerators) to a different circuit. If that's not possible, the only way to clean your line is to install a line conditioner—but those cost big bucks.

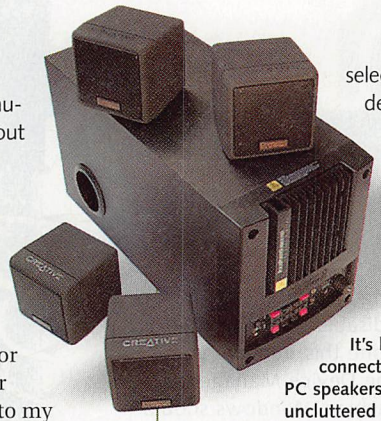
"Every time someone turns off an electrical appliance, I get a static discharge through my speakers."

In a Parallel Port Pickle

I was checking out the parallel port settings in my BIOS and saw options that included SPP, EPP, and ECP. What does each stand for and do? What settings should I use if I have a bubble jet printer and a flatbed scanner connected to my parallel port?

—Gino Aquino

All that SPP, SOS, VIP stuff can be a major pain in the ASS, but it's actually quite simple. SPP stands for Standard Parallel Port, which is basically your old-fashioned parallel port setting with speeds of about 150K/sec. EPP, or Enhanced Parallel Port, increases the speed to between 600K/sec and 1.5MB/sec and is generally selected for nonprinter devices. ECP, or Enhanced Capability Port, is comparable to EPP but is usually used for advanced printing devices. Since you're running two devices, select ECP.



It's best to connect your PC speakers to an uncluttered circuit.

I'm in AO-Hell

When I get a new program and am asked if I want to register online, or if I click on a URL when I am not already connected, either *Internet Explorer* or Netscape *Navigator* launch and try to connect. But I use AOL. Is there some program that will launch AOL instead of *IE* or Netscape?

—Jeff E.

First, we always urge those using AOL to make the switch to another ISP. You'll get better Internet performance and when you click on a link, your web browser will open and display the page. Second, the answer to your question is no. In order for AOL to open hyperlinks, it would have to be capable of launching when a URL is clicked (which it is), dialing by itself (which it isn't), and automatically opening a web browser and taking you to the linked site. If you're connected to AOL, clicking on a link will open a browser window. If you're not connected, it won't.

overclocker's CORNER

Beat the Clock

I've heard of people breaking the Pentium II "clock lock" before, but only for one or two boots. I think I may have made a new discovery about the clock lock. I have an ASUS P2B-D motherboard with a P-II 350. I found that when you place the CPU in the slot that's for the second CPU, then place the terminator card in the first CPU slot, the machine will boot up at whatever clock speed you want. The computer will boot a few times at that speed, then it won't boot at all. To make it boot again, remove the terminator card and boot the machine. It seems as though taking out the terminator card "resets" the CPU.

—Rilsy Foster

Mother, May I Overclock?

I'm trying to persuade my parents to let me overclock the family's computer, an extremely slow Pentium 75MHz. Their main concern is whether the extra 58MHz (the most possible with our mobo) is worth the risk of frying the CPU in our only computer. What should we do?

—Scott Clark

Scott, your parents must be so proud of you. Should you overclock? We have mixed feelings about it. On one hand, we generally advocate a pretty cavalier attitude towards overclocking—after all, a fried chip can be an excuse to upgrade. So, here are the pros and cons: If you overclock, you'll need a few hundred dollars for a cooling solution. But even then, there's a good chance that you'll end up with a steaming pool of CPU goo, since earlier Pentiums don't overclock particularly well. We think you'd be better off investing that dough in upgrading your system, given that most current software won't run on an overclocked CPU. A system upgrade will bring you up to date, and you'll be able to practice overclocking with impunity on the Pentium 75MHz. You could even try jacking your new, overclocking-friendly system.

If you try overclocking, we suggest that you secure a Peltier cooler, which is a heatsink with a thermoelectric cooler (TEC). Heat moves from one side of the TEC to the other, creating a hot side and a cool side. The cold side sits on top of the CPU, while the hot side straddles the heatsink. Peltier coolers are available at most computer stores, and are easily attached to the proc with a small clip.

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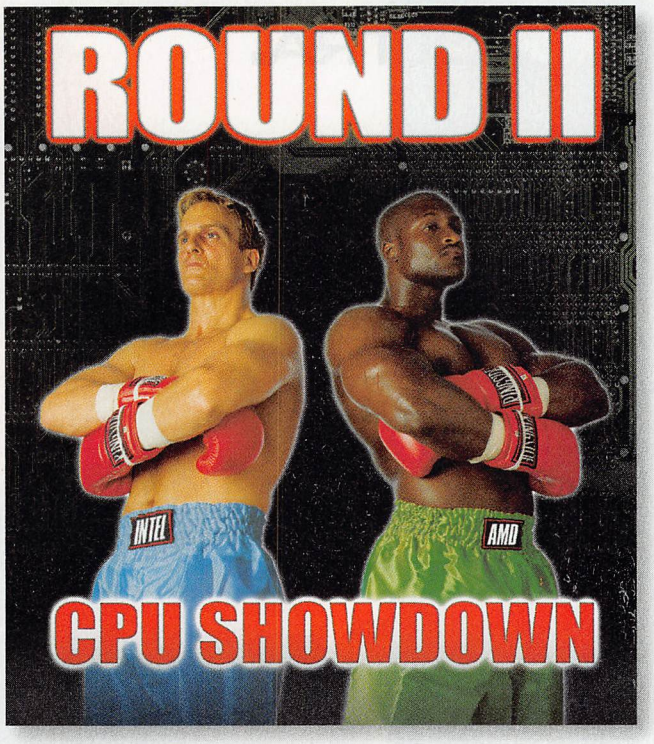
Who's got the fastest 600?

Now that Direct RDRAM and VC133 systems have arrived, the Pentium III vs. Athlon question becomes even murkier. Maximum PC levels the playing field to determine who is the boss of whom.

BY GORDON UNG AND JON PHILLIPS

After reading last month's Pentium III-versus-Athlon boxing reports, readers asked us which CPU would win if core frequency speeds were evenly matched, and all extraneous system variables were effectively removed from the decision. To this end, we pitted a 600MHz Athlon against a 600MHz P-III, using the same videocards and hard drive interfaces in each. Then, just for kicks, we added two more processor platforms to the CPU fight—the new bout thus becomes a four-way donnybrook. The contenders include: Athlon 600/100 with 100MHz SDRAM; P-III 600/100 with 100MHz SDRAM; P-III 600/133 with 133MHz VC133 SDRAM; and P-III 600/133 with 800MHz Direct RDRAM.



Creating a Level Field

To create a fair, level testing environment, we adjusted the innards of machines already sitting in the lab. At press time, the only Direct RDRAM and VC133 mobos at our disposal were already entrenched in Dell and Micron systems (featured on pages 108 and 114, respectively), so we used these machines as guinea pigs. Actually, our decision to retrofit two OEM boxes wasn't just for the sake of convenience: Direct RDRAM and VC133 machines seem to require tender engineering, and we thought it best to work with PCs that had already been QAed by teams of seasoned engineers with access to the absolute latest drivers and BIOS revs.

All four machines were equipped with 128MB of memory, and each was outfitted with a Diamond Viper 770 TNT2 Ultra clocked at 150MHz/183MHz, using nVidia's reference 2.08 drivers. The Athlon, Direct RDRAM, and VC133 machines had native ATA/66 support (care of their core-logic chipsets). We upped the 440BX-based P-III box to ATA/66 using a Promise Ultra ATA/66 controller. All four machines had 7200rpm ATA/66 hard drives.

Thus, our platform scuffle isolated CPU, chipset, and memory performance.

As for our benchmarks, we eschewed the usual suspects from our benchmarking arsenal, reaching instead for extra tools to see what kind of new information we could extract. The new tests included:

▶ **Quake II 3.20 Crusher Demo** This multiplayer demo pushes the CPU to the max by forcing it to track the movements, physics, and frags of dozens of people.

▶ **Quake III Arena Test** Uses better physics and far more polygon-intensive models than *Quake II*. Every feature, along with trilinear filtering, was enabled during testing.

▶ **MP3 Encoding** Music encoding is an ever-prevalent PC pastime, and readers want to know which piece of silicon rips tracks the quickest. Using *Music Match 4.1*, we encoded the first three tracks from a Cornershop CD, for a total of 12:42 minutes worth of music.

▶ **P-III Business Apps** Developed by Intel, this benchmark runs SSE-optimized versions of Dragon *Naturally Speaking*, Microsoft *Netshow Encoder*, and Adobe *Photoshop 5.2* through intense action scripts. We essentially wanted to separate the girls from the women in the Intel camp. We should note that in previous months, Athlons have beaten P-IIIs in the *Netshow Encoder* script, proving that even SSE can't always bail out Intel.

▶ **Platform Tests 1.1** Immediately after Intel trotted out these benchmarks to prove that Direct RDRAM and AGP 4x offered better performance, critics said Intel tilted the tests to favor its most-favored technologies. Regardless, we still wanted to see how well competing technology performed. These tests pound system memory with 6GB of data to judge overall bandwidth, then rotate a 3D model with eight panes of streaming AVIs to judge AGP performance. Bandwidth scores are expressed in MB/sec; model rotations are expressed in frames per second.

▶ **STREAM** Based on tests used to determine the bandwidth of supercomputers, *STREAM* conducts five CPU operations that are so large, they must be executed out of cache—a good way to gauge actual memory-bus throughput. We averaged all five results to come up with a single number.

▶ **Multitasking Tests** Direct RDRAM purports to offer superb multitasking opportunities, allowing you to, for example, run a virus scan while simultaneously working in a heavy-duty app, with no obtrusive impact. To test this, we ran a McAfee *VirusScan* while

PHOTOGRAPHY BY JACK HUTCHESON

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simultaneously running our *Quake III* test; then we ran the same *VirusScan* during *Maximum PC's* standard *Photoshop* test.

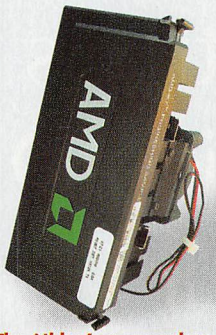
Our Findings

Before analyzing the results, we should make one point extremely clear: Benchmark results can be affected by the vagaries of any particular testbed's BIOS, Registry, and DLL configurations. And as is often the case with new, finicky chipset and memory technologies, these configurations can be optimized for stability rather than performance. For example, the presence or omission of a single DLL, or the innocent toggle of a memory-latency setting in the BIOS, can skew results in either direction. Take this into account when peeling through our benchmark chart. If nothing else, interpret our findings for what they really are: Evaluations of how typical system configs performed with a particular mix of synthetic and real-world benchmarks.

DARE TO COMPARE

CPU	AMD 600MHZ	INTEL PIII 600MHZ	INTEL PIII 600MHZ	INTEL PIII 600MHZ
Frontside bus speed	200MHz *	100MHz	133MHz	133MHz
Memory type and amount	128MB PC100 SDRAM	128MB PC100 SDRAM	128MB 800MHz Direct RDRAM	128 VC133 SDRAM
Chipset	AMD 750 Irongate	Intel 440BX	Intel 820 Camino	VIA VT694X
Quake II 3.20 Crusher 800x600	66.9 fps	62.4 fps	59.3 fps	60.9 fps
Quake III Test demo1 1.08 800x600	45.3 fps	45.7 fps	45.1 fps	45.0 fps
MP3 Encoding (lower is better)	166 sec.	117 sec.	118 sec.	150 sec.
SSE Apps–Dragon Naturally Speaking (higher is better)	154	177	179	189
SSE Apps–Microsoft Netshow Encoder (higher is better)	187	183	188	192
SSE Apps–Photoshop 5.0.2 (higher is better)	167	265	252	264
Platform Tests 1.1	N/A** 27.1 fps	553MB/sec. 26.6 fps	1,479MB/sec. 36.3 fps	847MB/sec. 35.6 fps
STREAM (higher is better)	446	320	375	370
Multitasking VirusScan/ Maximum PC Photoshop 5.2 test (lower is better)	135 sec.	139 sec.	143 sec.	140 sec.
Multitasking VirusScan/ Q-III 800x600 test	28.9 fps	40.8 fps	41.1 fps	40.6 fps

* The Athlon actually employs a 200MHz CPU-to-chipset channel, not a traditional system bus that must also support peripheral bus activity.
** The Athlon cannot run this Intel-developed test.



The Athlon's memory bus triumphed in Photoshop/ VirusScan multitasking—and we even used an SSE-enabled Photoshop version!

That said, Direct RDRAM proved to be a disappointing failure, showing no compelling performance dividends. The Direct RDRAM machine stood out only in the Intel bandwidth test, flirting very closely with its 1.6GB/sec maximum ceiling (so at least the test proved that the Camino/820 bus was in full working order). Even in the multitasking tests in which Direct RDRAM should have excelled, the new memory standard showed no earth-shattering performance benefits. Sure, the Direct RDRAM-based box spit out the fastest framerates in the *VirusScan/Quake III* test, but it only eked by the competing VC133 and PC100 systems. Overall, Direct RDRAM and Camino/820 left us totally unexcited. Someone needs to find a compelling reason to shell out the ducats for this expensive memory before the Rambus runs off the cliff with everyone onboard.

In the Pentium III Business Apps tests, VC133 memory paired with VIA's VT694X chipset proved to be the fastest setup. Even in Intel's Platform Tests, VC133 turned in a fair score of 847MB/sec compared to the PC100's 553MB/sec. VC133 faired well in the *STREAM* test, as well. Nonetheless, 133MHz memory (let alone superfast 800MHz memory) didn't prove fully dominant over PC100. The new memory standards are incremental, not revolutionary, improvements—at least in real-world application testing. In this respect, Intel's famous 440BX chipset looks like it's still in the ballgame. If you're thinking about dumping that BX mommyboard for an 820 supervixen, we suggest you wait for further test results.

Given that both the Camino/820 and VIA chipsets support AGP 4x, we were expecting to see great boosts in the performance of our AGP 2x/4x TNT2 Ultra videocards. Mysteriously, the jump to AGP 4x had no significant impact. So, what happened? When a card is called 2x/4x, does that distinction simply mean the card will work in either a 2x or a 4x motherboard? Or are today's games and videocards perfectly suited to each other, and AGP 4x technology simply isn't necessary yet? We will continue to investigate these ever-evolving questions. But in the meantime, ponder this: In Intel's torturous 3D platform test, the chipsets that support AGP 4x yielded significantly faster framerates—yet we didn't see any 4x AGP benefits in our *Quake III Arena* test! When will we *really* need AGP 4x?

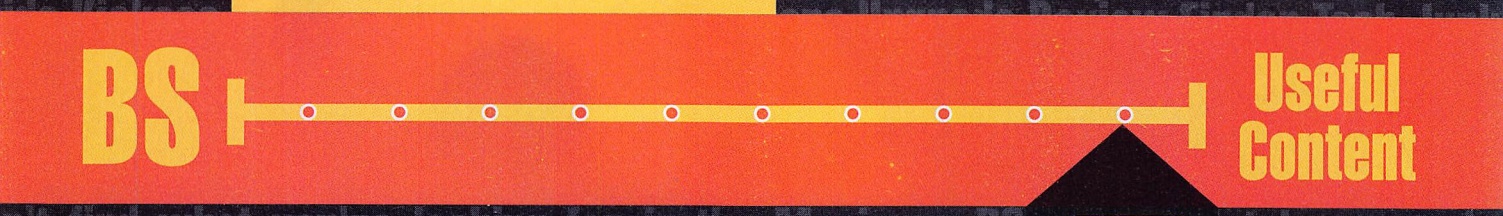
Only one thing became clear after spending time in the lab with these four machines: The Intel Pentium III is the faster processor if you do all your work in SSE-optimized apps. If you're a gaming junkie, the Athlon looks to have more raw floating-point power, as evidenced by its triumph in the *Quake II Crusher* test.

But be aware of the Direct RDRAM machine's triumph in the Intel Platform Tests. If these synthetic benchmarks are any indication of how real games will perform in the future, you may indeed need the power of Direct RDRAM and AGP 4x. For this holiday season, however, when *Quake III Arena* portends to be the most demanding game available, your warhorse of a BX box may be the only machine you need.

The results of our four-way 600MHz melee are interesting from a purely intellectual standpoint, but have little bearing in a world where sheer clock frequency remains king (this was proven definitively in last month's fight). When making a choice among any of the CPU/bus/memory platforms featured here, go for the machine that hosts the fastest processor. When working in a single app, a basic 50MHz bin advantage on the CPU level will give you vastly greater performance than a "more ambitious" core CPU architecture or faster memory bus. Intel has proven this for years, and AMD is just beginning to use the same strategy.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

BS Rating:



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MaximumPC.com:

Maximum Useful Content / Minimum BS

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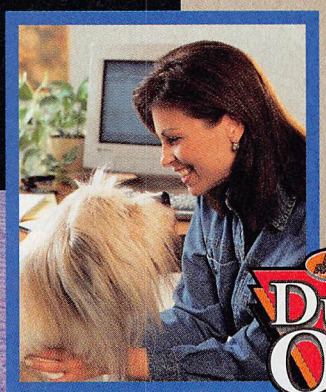

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REVIEWS

KICKIN' THE TIRES ON THE LATEST HARDWARE AND TAKIN' THE LATEST SOFTWARE OUT FOR A SPIN

Hardware Photography by **JORN BLOHM**

TESTING POLICY

EDITOR'S CHOICE AWARD: Only 9 and 10 verdicts are even eligible for the coveted Kick Ass award, the mark of PC excellence.

Our product evaluation process is built on down-and-dirty, hands-on testing. All hardware benchmarking is conducted in the *Maximum PC* lab by *Maximum PC* editors, and whenever possible, we use real-world applications to gauge performance. Our final verdicts, which fall on a scale from 1 to 10, are based on both benchmark results and a subjective appraisal of product features.

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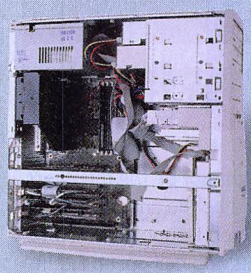
Online Guide to Benchmarking

You can always go to **www.maximumpcmag.com/benchmarking** for the complete explanation of *Maximum PC*'s benchmarking policies.

How to Read the Benchmarks

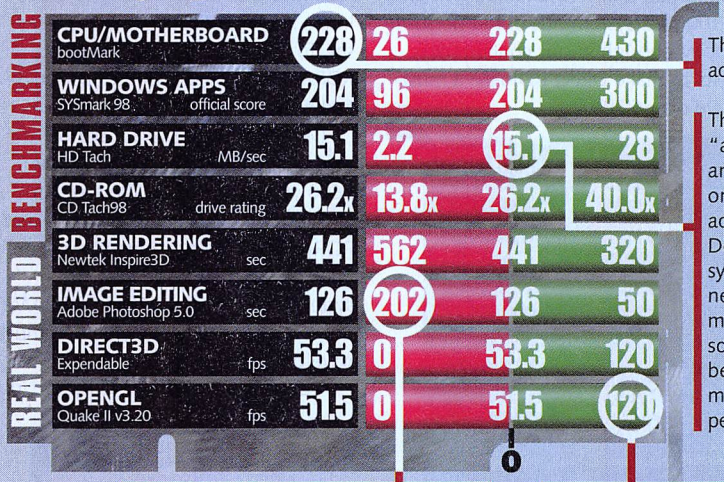
Our Dell Dimension test system is used to establish zero points for all desktop benchmarking and as a test bed for individual component evaluation. The Quantex notebook serves the same purpose for notebook reviews. The base system scores represent the average acceptable performance of high-end machines as of 07/99. We will update the mid-point systems every six months with machines from different OEMs.



DESKTOP ZERO-POINT SYSTEM: Dell Dimension XPS T500: P-III 500MHz, 440BX chipset, 128MB 100MHz SDRAM, 32MB TNT2 videocard, 12.7GB 7200rpm UDMA/33 hard drive, 40x (advertised speed) CD-ROM.

NOTEBOOK ZERO-POINT SYSTEM: Quantex I-1410: 366MHz mobile Pentium II, 96MB SDRAM, 8MB ATI Rage LT Pro video chipset, 8GB hard drive, 4x DVD-ROM.

Desktop Systems



The specific score achieved by the system.

The mid-points denote "acceptable performance" and are based on the precise scores achieved by our base Dell and Quantex systems. As we review new systems each month, their benchmark scores will fall either below or above the mark of acceptable performance.

The more a system underperforms the mid-point system, the further into the red its bar moves. The numbers shown at the low-point are the lowest scores we expect to see in any shipping product.

The more a system outperforms the mid-point system, the further into the green its bar moves. The numbers shown at the high-point are the best scores we expect to see in the next six months.

Dell Dimension XPS B600

BLAZING FRAMERATES—FOR A PRICE

Dell's new B600 incorporates Direct RDRAM, a new technology in search of a purpose.

Dell's XPS B600 defines the current state of the art in PC technology. Into the B600's unassuming case, Dell tucked almost every item on our technology lust list: nVidia's hot new GeForce 256 graphics card with 32MB of RAM operating at a full 4x AGP, (theoretically double the bus bandwidth of 2x AGP); a 133MHz system bus—the first bump in frontside-bus speed since the 350MHz Pentium II was introduced; 128MB of Direct RDRAM blazing at 800MHz; no ISA slots, eliminating PCI latency; and Ultra ATA/66, courtesy of Intel's 820 Camino chipset.

Given this list of orgasmic features, our socks should've been blown off, rolled up, and FedExed to Dell's HQ in Texas. Instead, the best the B600 could do was untie our shoelaces.

Sure, the B600 delivers on the gaming front: Its CPU/Rambus/GeForce combo hands-down destroyed our *Quake II* benchmark, exceeding the TNT2 Ultra's fastest score by 40fps. The B600 conquered our *Quake III Arena* test, too. Even with every eye-candy feature turned on—a feat few machines can handle—it churned out an impressive 55.4fps at 800x600.

Perhaps our disappointment results from the fact that our high expectations for Intel's newfangled 820 Camino chipset just weren't met. We were sure the 800MHz Direct RDRAM would kick sand all over the old-guard BX chipset and PC100 SDRAM memory. Instead, the B600 just edged past its predecessor, the T600, by only eight points in SYSmark, and was no faster than the T600 in our *Photoshop* test. What went wrong?

Dell implemented the expensive Direct RDRAM memory so that the B600 could realize the benefits of concurrency—the ability to perform multiple tasks simultaneously, such as burning a CD while playing a game or scanning for viruses in the background, with almost no performance penalty. In that respect, Direct Rambus almost fulfills its promise. Duplicating a disc on the Sony CD-RW didn't affect *Quake II* and *Expendable* benchmark scores. And copying files across a USB network dinged framerates less than 5%. Running McAfee *VirusScan* during our benchmarks dragged *Quake II* down to a still-playable 74fps and slowed the *Photoshop* test from 106 seconds to 138 seconds. The problem is, we found that a 600MHz Pentium III on a 100MHz system bus didn't perform poorly enough in our concurrency tests to make Direct RDRAM a must-have over SDRAM.

But this might not be the memory's fault. This could be the end of the road for the .25-micron technology used to fab Pentium IIIs and half-speed L2. In fact, Dell's main reason for including Direct RDRAM in its systems now is to ease future CPU upgrades, such as to Intel's .18-micron Coppermine processor. To take full advantage of Direct RDRAM, you might need Coppermine and its full-speed L2 cache.

Despite stellar *Quake II* performance, the B600 doesn't justify the $600 you'll spend over the standard 600 system. (Strange—Dell said Direct RDRAM wouldn't command a painful price premium.) Considering this system's performance, Direct RDRAM isn't worth the Benjies unless you must have bragging rights.

—Gordon Ung

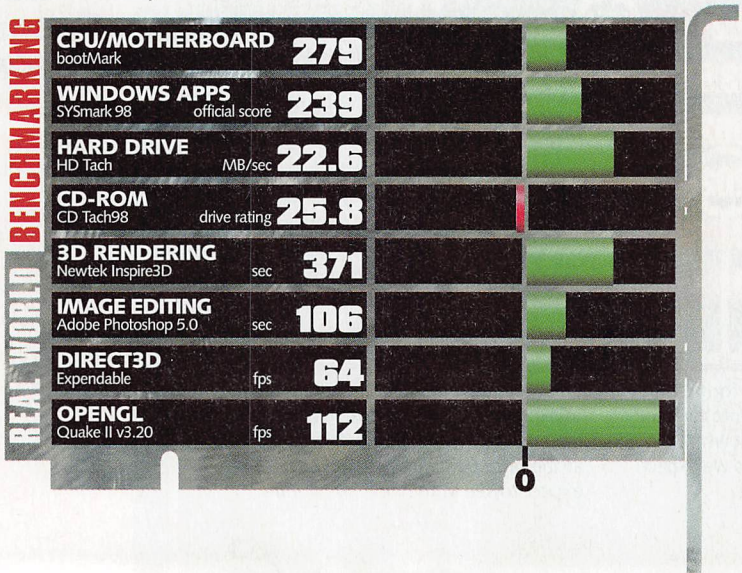
PLUSES
- GeForce 256 rocks
- AGP 4x
- 800MHz Direct RDRAM
- No ISA

MINUSES
- Price
- Incremental speed increase
- Bland case

UNDER THE HOOD

THE BRAINS	
CPU	Intel Pentium III 600MHz with a 133MHz system bus
L2 Cache	512KB closely coupled, half-core speed
RAM	128MB 800MHz Direct RDRAM with ECC (expandable to 768MB)
Motherboard	Dell version of Intel Vancouver
Total Drive Bays	Two 5.25, four 3.5
I/O Ports	Two USB, two serial, one parallel, one gameport
DISPLAY	
Graphics card	nVidia GeForce 256 32MB
Monitor	Dell M990 19-inch
Maximum Resolution/RefreshRate	1600X1200 @ 79MHz
STORAGE	
I/O	ATA/66 IDE
Hard Drive	20.4GB Ultra DMA/66 7,200rpm Maxtor
CD-ROM/ DVD-ROM	Hitachi GD-5000 DVD
Removable Media	1.44MB floppy
Fax/Modem	U.S. Robotics Voice WinModem
SOUND	
Sound	Creative Labs Live! Value 512V
Speakers	Harmon Kardon HK-595
THE BUNDLE	
Microsoft Works Suite 99	

BOOT 0:59 DOWN 0:02



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Price $2,745; $3,079 with 19-inch monitor
Company Dell
Phone 800.388.8542
URL www.dell.com

8

EXPANSION NOTES

You have plenty of space to grow with the B600. With five PCI slots—three of them open—and a USB keyboard instead of PS/2, you'll go broke before filling everything up.

EXPANSION MAP

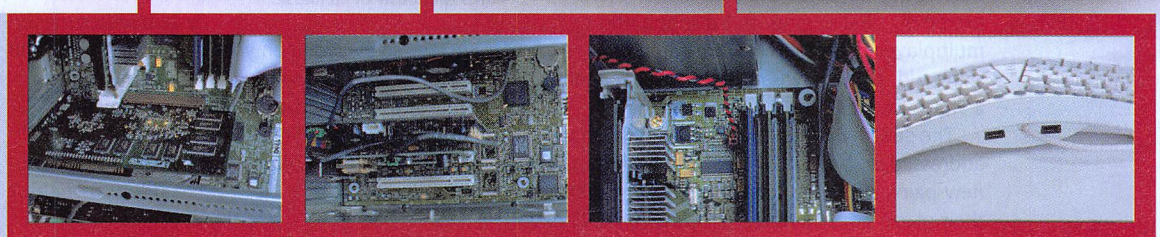
AGP Graphics card
PCI Free
PCI Free
PCI Soundcard
PCI Modem
PCI Free

IROS

00 System timer	**08** system clock
01 keyboard	**09** WinModem
02 Interrupt controller	**10** Bus controller
03 SB Live	**11** nVidia GeForce
04 Free	**12** PS/2 mouse
05 Free	**13** Num data proc
06 Floppy port	**14** PCI Busmaster IDE
07 LPT1 printer port	**15** Secondary IDE

DMAS

01 Soundcard	**03** DMA controller
02 Floppy disk controller	**04** SB16 emulation



GeForce Unveiled nVidia maintains its momentum with the GeForce 256, which packs 32MB of RAM. Tied to the 4x AGP bus in the B600, GeForce 256 is the fastest *Quake II* card we've seen.

ISA Less Intel uses a "Low Pin Count" bus to hook low-priority peripherals such as PS/2, serial, and parallel to the system bus. This lets the B600 ban all ISA slots.

That's No Yellow Bus Direct RDRAM modules are capped in aluminum sleeves that act as heatsinks. Next to the 128MB RIMM sit two repeated modules used to complete the circuit.

Where's Chim Chim? Microsoft corrected its blunder with the cursor keys on its new "Speed Racer" keyboard, and added Internet and volume keys and USB ports.

NASTY TRICKS & BAD HABITS

A vicious little trick now available to your enemies involves burrowing an APC full of engineers into your base. Here's how to smack down that action:

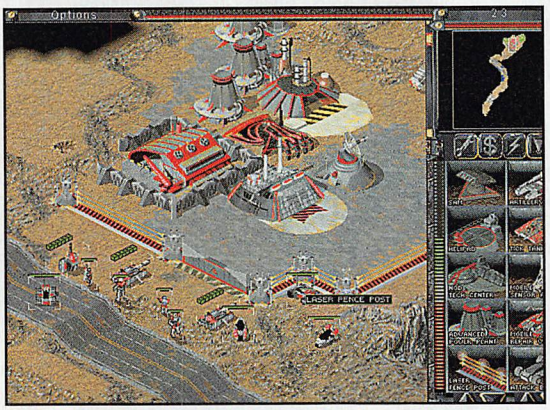
▶ First, lay down your MCV, a power plant, and barracks. If you can afford it, also build a refinery, but nothing more. Immediately build a chunk of pavement next to your construction yard.

▶ Select your yard and command it to redeploy onto the freshly paved tarmac. Don't waste any time, as this is the most likely opportunity for an early raiding party to attack your base. Once you're back in business, lay pavement over the spot you just vacated and over as much of your base area as you can afford. Don't forget to save enough money for a refinery if you don't already have one.

▶ As soon as you can, completely encase your construction yard in a wall, thereby thwarting the best-laid plans of engineers the world over. Take that, you evil AI bastards!

Command & Conquer: Tiberian Sun

TIBERIAN "BEEN DONE"



After five years of hype and secrecy, *Tiberian Sun*—the long-awaited follow-up to *Command & Conquer*, the granddaddy of all RTS games—has arrived. While *Tiberian Sun*'s gameplay is as fun as the original's, it seems Westwood's developers chucked innovation out the door. Yeah, we know Westwood stopped and restarted *Tiberian Sun*'s development about a dozen times during those five long years, but this game might have fared better if it had been released in 1997 to compete with the likes of *Diablo*. Even though *Tiberian Sun* will most likely be the best-selling game of the year, it lacks the oomph, the extra wow that a five-year gestation period should have produced. Pity.

THE SPECS

3D CARD SUPPORT
None

3D SOUND SUPPORT
Stereo only

MULTIPLAYER
TCP/IP IPX modem

NUMBER OF PLAYERS
8

PLUSES
- Classic gameplay
- Improved graphics
- Destructible terrain

MINUSES
- Graphics circa 1997
- Slow unit movement

In *Tiberian Sun*, the forces of GDI and NOD once again battle for control of the Third Rock, and all your favorite units back in action. Players of the original will find comfort in old friends such as stealth tanks, engineers, and commandos (now inexplicably called Ghostwalkers), and will jump with glee at new units such as the Devil's Tongue burrowing flame tank, and Wolverine and Titan mechs.

As in the original, the objective of *Tiberian Sun*'s is to gather the most dough and build the most units. Some of the solo missions are extremely challenging, but disappointing multiplayer deathmatches are same old, same old. Multiplayer hookup is once again a snap via LAN, Internet or modem.

The severity of tank rushes has been mostly addressed with the advent of the EMP gun, but new pains in the ass have popped up to take their place. For example, followers of NOD have access to a wicked chemical missile that turns enemy troops into mutants capable of killing everything in sight. Artillery is ridiculously powerful, especially against computer targets in co-op multiplayer games, but actually eliminating computer opponents is nearly impossible because they're so hard to reach. A few annoying AI bugs occur from time to time, such as units getting stuck in construction-bay doors or refusing movement orders (which means yes, Virginia, you have to nuke the bay and build another before you can build more units—argh!) And the computer-driven ion cannons see right through your stealth generators every time.

The best defense is always a good offense, and nowhere is that more true than in Tiberian Sun.

Although 3D acceleration is absent from *Tiberian Sun*, Westwood's developers twisted the terrain by 45 degrees and added hills and dales to the classic green-rock fields, creating a *SimCity*-esque "3D" look that makes for a more visually interesting board. Resolution is limited to 800x600, but anything smaller would make it impossible to select and control individual units. System requirements are low, so everyone on your block can stay up and keep you company while you're losing valuable shuteye to this soon-to-be bestseller. However, although *Tiberian Sun* is a blast to play, we're disappointed. It could have been so much more.

—Phil Lacefield Jr.

GDI Titans carry impressive firepower, but are fragile; use them either cautiously or en masse.

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Image Editors on the cheap

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With the recent emergence of low-priced scanners, affordable digital cameras, and photo-processing labs that save images to CD-ROM, getting your memories recorded into a digital format is no longer a hassle. Now you just need to figure out what to do with the images once they're on your PC. Enter the following apps, the best of which will help you go wild with creative tinkering. Potential projects include: color correcting and resizing, removing red eye and facial blemishes, creating greeting cards and montages, and even uploading your pics to a web site. Here we review the latest editors; see page 83 for some killer projects.

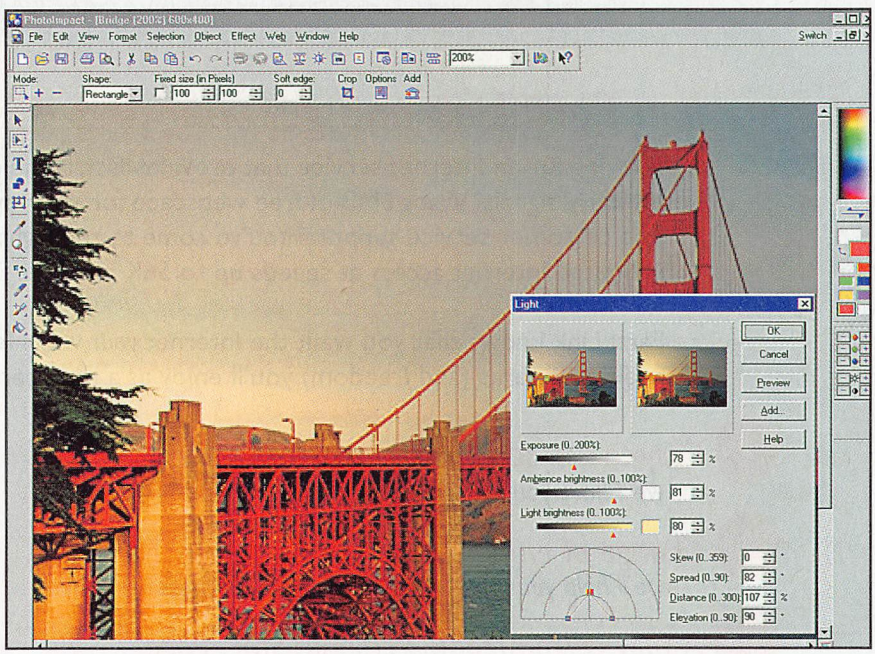
—Linda Lee

PhotoImpact 5

For the second year in a row, Ulead's *PhotoImpact 5* takes the top prize as the best consumer image editor on the market. This solid application is robust, mature, and easy to use, and offers the widest array of productivity tools available to help you generate outstanding graphics for both print and the web.

Among the first things you'll notice is the Microsoft *Office*-like interface, which helps reduce the learning curve for new users. You can move toolbars anywhere in order to make your work environment comfortable, and right-clicking brings up a menu of power options. When you select a tool, the attribute toolbar changes and displays the options for that tool. For example, options for the selection tool include mode, shape, edge, and crop. *PhotoImpact 5* also lets you specify up to 99 levels of undo.

The app provides you with a range of choices for correcting a digital image. For those who don't want to go through a step-by-step process, an Auto Process agent adjusts brightness and contrast, hue and saturation, and focus, as well as performing straightening and cropping duties. There's also a batch process mode that despeckles and removes moiré. However, while some of our automatically enhanced images looked fine, many ended up over-sharpened and under-cropped, leaving damaged edges as part of the final image.



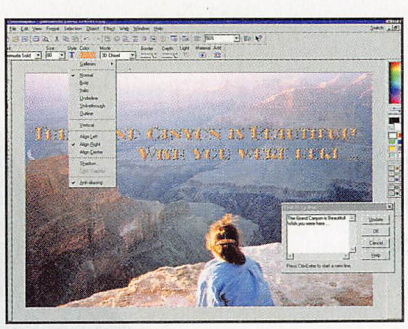
Go from daylight to dusk over the Golden Gate Bridge with PhotoImpact's light effects.

Those who require more creative control but still want help during each step of the correction process will appreciate the Post-Processing Wizard, an intuitive tool that lets you modify color channels and tweak brightness, contrast, and gamma via a slider or a numerical entry. But what really sets *PhotoImpact 5* apart from the pack is its superior creative tool set, which includes a wide range of preset effect filters. Applying effects such as Lens Flare, Snow, or Clouds is as easy as dragging the effect from the palette and dropping it on your image.

Making personalized greeting cards is a cinch with *PhotoImpact 5*. You can drop text onto any part of an image. Text properties such as font, size, style, alignment, color, and 2D/3D mode are all fully adjustable.

In early revs, *PhotoImpact* earned high marks as a groundbreaking tool for web graphics, and this version continues the trend. The easy-to-use Java Rollover Assistant helps you create Java rollover buttons for your web page (no Java experience required!). Ambitious users will also appreciate *GIF Animator 3*, which boasts an Animation Wizard that helps you rapidly create your first animations. And the Image Optimizer for JPEG, GIF, and PNG export is by far the best we've seen for controlling and previewing image compression.

PhotoImpact 5 combines an extraordinary number of effects with professional functionality and consumer-level ease-of-use. Feature for feature, it's the best value in this roundup.



PhotoImpact's Text Tool provides editable control over all text attributes, including size, style, font, and color.

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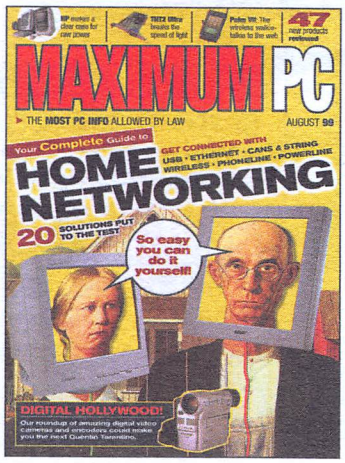

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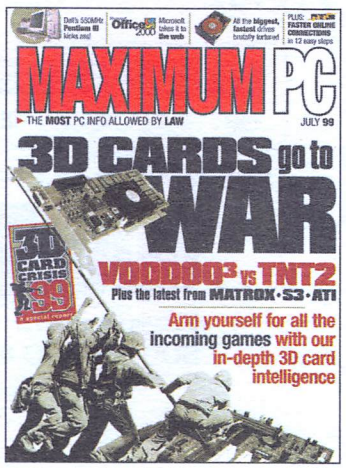

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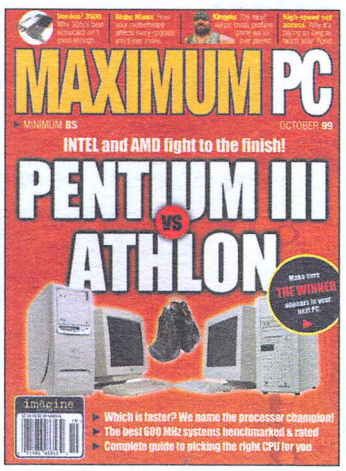

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MAXIMUM PC

The ultimate upgrade for savvy PC owners.

Canon Photo Gold

Canon's entry into the consumer image-editing arena shows that it's definitely a version 1.0 product, which gives it an immediate disadvantage when compared to mature software such as *Photoshop LE* and *PhotoImpact 5*.

Those who prefer menu-driven tool access will be disappointed, as almost every function is sequestered in a remote control-style tool box. Instant image correction is limited to just two types of automatic enhancements. You can't customize your interface or work area, or move a remote control from its location, and there are just five sizes of touch-up brushes to choose from—a real drag if you plan to do much creative work. *Photo Gold's* drawing tools are also limited. Though the included special effects are neat, there are only 16 of them—notably fewer than the number offered by most other image-editing programs.

Canon's Photo Gold offers a Photoshop Variations-style adjustment too that makes changing the tint a visual endeavor. A slider controls the difference between your choices.

Photo Gold does have its finer points, however. Users can easily print out digital photographs of various sizes, making it easy to output your own pics if you have a color printer. There's also an easy-to-use QuickTime VR utility for creating 360-degree panoramic images.

Photo Gold has low system requirements, so it could be a good choice for those with older machines and not much RAM.

Otherwise, we'd rather spend the extra $10 and buy *PhotoImpact*—there's just no compelling reason to purchase *Photo Gold* instead.

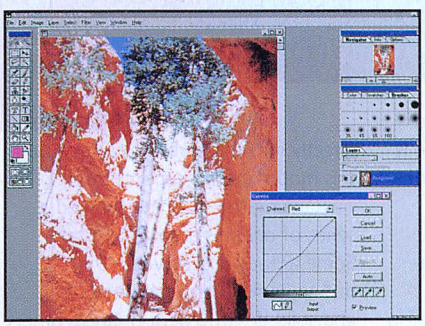
MAXIMUM PC VERDICT

Price $70
Company Canon
Phone 714.438.3000
URL www.software.canon.com

4

Photoshop Limited Edition

The main problem with *Photoshop Limited Edition* is that it can't decide who its audience is. Based on *Photoshop 5*, this truncated version clearly targets hobbyists and business pros (Adobe reserves for the complete version all the high-end features that are absolutely necessary for graphics professionals). Among the missing features are multiple undos, a tool that would make experimentation easier and far less risky for image-hackin' newbies. Support for CMYK and LAB color are also MIA.



Photoshop LE's Curves tool gives you all the control over Red, Green, and Blue color channels that you'd expect in a pro-level image-editing application.

Though its target audience is non-pros, *Photoshop LE* doesn't offer an accessible and automatic way for novices to fix their photographs, a staple in other products at this level, such as *PhotoImpact* and Adobe's own *PhotoDeluxe*. The closest equivalent here is the Auto Levels command, which automatically sets black and white points, defining the darkest and lightest pixels and then redistributing colors accordingly.

Other sorely missing features include vector-path tools and batch processing. We'd also like to see a preview option as part of the JPEG export.

On a positive note, *Photoshop LE* offers just about every other tool you're likely to need. You get Adobe's standard interface and an elegant implementation of Layers, which certainly make it easier to compose complex images. You can name each layer, and special icons control a layer's visibility. There's also a wide assortment of correction and enhancement tools, and dozens of filter effects.

Overall, *Photoshop LE* is a strong product, but it simply doesn't deliver the value of *PhotoImpact*.

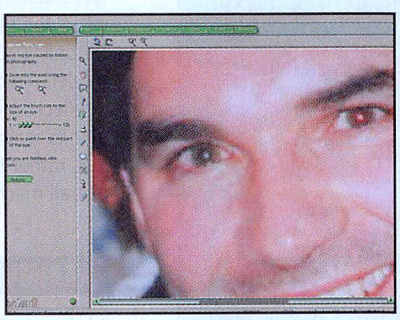
MAXIMUM PC VERDICT

Price $100
Company Adobe Systems Inc.
Phone 800.833.6687
URL www.adobe.com

7

PhotoSuite III Platinum

PhotoSuite III's strongest feature is its easy-to-use interface, which helps users follow a logical editing strategy. A nav bar across the top of the screen leads you through the process of obtaining, enhancing, saving, and sharing images. For each task, a context-sensitive Activity panel organizes the relevant sub-tasks. For instance, in Touchup, choices include Remove Red Eye, Remove Blemishes, and Touchup brushes. Overall, the interface itself is slick and well-organized.



PhotoSuite III's Remove Red Eye function preserves a photo's highlights by removing the red value rather than inserting black. Here, the left eye has been retouched, while the right eye has not.

PhotoSuite III includes the standard assortment of enhancement and creative tools. For image editing, you'll find tools for sharpening, brightness and contrast, and color adjustment. The best part is that all the tools were designed with novices in mind: You can tweak red, green, and blue levels, but only across the whole image, and there are only two levels of sharpen.

Special effects are where this app excels. Among other options, you get natural effects such as snow and fog, and lens effects such as antique and sepia. You can also apply various warping effects, and the amazing PhotoTapestry tool will transform your image into a photo mosaic.

PhotoSuite III offers many compelling features for one of the lowest retail prices around, but it's also a resource hog that takes up to 805MB of hard disk space for a complete install—and as far as we're concerned, that's a hefty price to pay.

MAXIMUM PC VERDICT

Price $50
Company MGI Software
Phone 888.644.7638
URL www.mgisoft.com

7

Micron Millennia 600 133

NEW GOODIES, SAME PERFORMANCE

The future has arrived.

PLUSES
- GeForce, nuff said
- Mobo designed for power freaks
- MPEG decoder and 5.1 speakers included
- Case is a work of art

MINUSES
- Just as fast at BX model
- Monitor is a fishbowl; don't get it as a bundle

When we received Micron's GeForce-equipped, 133MHz FSB, 4x AGP Millennia, we couldn't wait to tear it open and test it. Heck, after we saw the GeForce nestled in the AGP slot, we almost went number one right on the lab linoleum. But once testing began and benchmark scores began to roll in, the squeals of delight emanating from the test lab slowly turned to muffled sobs of disappointment.

It's not that the Millennia 133 is slow, mind you; it's one of the fastest desktops we've ever tested. But it's only a wee bit faster than the BX-based Millennia we tested last month, and we expected a lot more.

We give Micron a ton of credit for shunning Intel parts in their top-of-the-line box, opting instead to include VC133 SDRAM with a VIA core-logic chipset. VC133, or Virtual Channel Memory, utilizes 16 separate channels of wicked-fast SDRAM running at 133MHz, and is a standard that's competing directly with Intel's Rambus. But the addition of a 133MHz frontside bus had a negligible impact on performance.

To wit, the Millennia 133 scored 239 in *SYSmark*; the BX system reached a score of 234. In the bootMark test, the two machines benched within one point of one another, and in the *Inspire* 3D rendering test, the Millennia 133 edged out the BX by a scant three seconds. The similarities continued throughout our battery of tests until the GeForce took center stage for the Direct3D and OpenGL benchmarks. By then, we were skeptical that any benchmark would show the Millennia 133 to be superior, but the GeForce took us completely by surprise. Using its quad-rendering pipelines, the 256-bit accelerator pumped out 113 frames per second in *Quake II*—over 40 frames per second more than the previous champ, the venerable TNT2 Ultra. Though game developers probably won't use the GeForce's transform-and-lighting engine until some time after the card's release, the GeForce is undeniably fast and takes the title of fastest *Quake* card.

We were also impressed by the Millennia's motherboard, which features both a Slot 1 for its P-III 600 proc and a socket 370 for Celeron buffs (though you can't run dual procs). A motherboard this nice should be kept cool at all times, so Micron splurged with two huge fans that blow frosty love directly onto the proc-zone. All your ISA cards can be placed directly into the garbage can, 'cause this mobo doesn't support them.

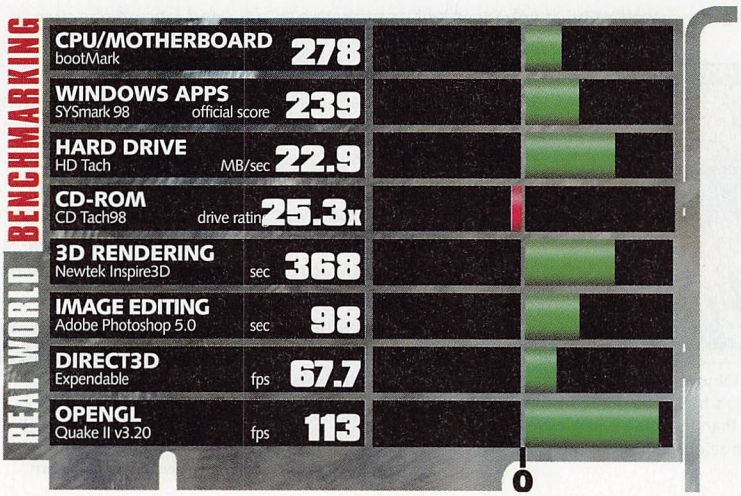
Ranking this machine sparked a series of debates among the staff. Some argued it deserved a 9 or 10 due to its next-gen componentry and solid desktop performance; others felt it warranted a 6 or 7 based on its uninspired benchmark performance compared to the similarly configured BX model. We decided on a 9. Overall, the Millennia 133 is faster than the last Micron system we reviewed (which received a 9/Kick Ass), and it gets props for adding the GeForce and 133MHz system bus to what was already a smoking box—all for only $200 more than the BX model. Revoking the Kick Ass is more a reflection on the negligible performance realized by the faster system bus, rather than a black mark on the overall machine's stellar record.

—Josh Norem

UNDER THE HOOD

THE BRAINS	
CPU	Intel Pentium III 600
L2 Cache	512K internal
Moboard	Tyan S1854 AGP4x
Drive bays	Three 5.25-inch, five 3.5-inch
I/O Ports	Two serial, one parallel, two USB
DISPLAY	
Video	Creative Labs GeForce 256, 32MB SDRAM, AGP4x
Monitor	Hitachi 21-inch CM812
Res/Refresh	1280x1024/85Hz
STORAGE	
Hard Drive	IBM Deskstar 25.37GB 7,200 rpm, Ultra DMA/66
DVD	NEC 8x DV-5500A
Removable	Floppy, Sony CD-RW
Fax/Modem	U.S. Robotics 56K WinModem
SOUND	
Sound	Aureal Vortex AU8830 with A3D 2.0
Speakers	Cambridge Soundworks DeskTop Theater 5.1 DTT2500 Digital
OTHERS	
Creative Labs PC-DVDEncore Dxr3	
THE BUNDLE	
Microsoft Office SBE 2000 I DirectX 7 I Norton AntiVirus 2000 I Micron University I Trellix Web I Authoring Tools I Tioga DMA Protection I MRestore	

BOOT 1:04 DOWN 0:04



MAXIMUM PC VERDICT

Price $2,360, $2,990 with monitor
Company Micron
Phone 888.228.9634
URL www.micronpc.com

9

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

EXPANSION NOTES

We are extremely happy to see a board with three open PCI slots and zero skanky ISA slots. You also get a home for your Socket 7 CPU and three free 3.5-inch bays.

EXPANSION MAP

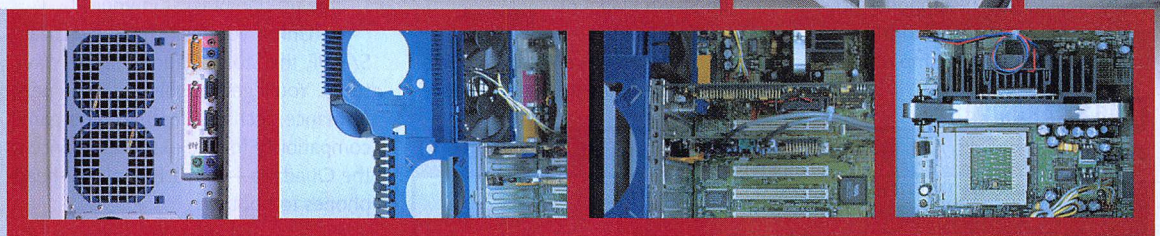
AGP	nVidia GeForce
PCI	free
PCI	Aureal Vortex
PCI	Creative Labs PC-DVD Encore Dxr3
PCI	free
PCI	free
PCI	USR WinModem

IROS

01 keyboard	**09** Soundcard
02 Interrupt Controller	**10** PCI to USB host
03 IRQ holder	**11** Modem/GeForce 256
04 COM1	**12** PS/2 Mouse
05 MPEG card	**13** Num data proc
06 floppy	**14** IDE controller
07 LPT1	**15** IDE controller
08 System Clock	

DMAS

01 Soundcard	**03** Soundcard
02 Floppy	**04** DMA controller



Backfan Give your proc a blow—er, nevermind. Two big fans keep things cool.

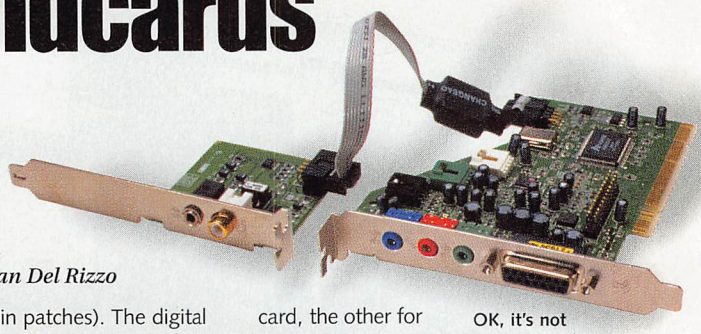
Plastic fantastic This blue contraption holds optional fans, keeps the PCI cards at bay, and has no screws.

No ISA Demons be gone! Micron 86'd the ISA slots and threw in six PCI slots.

Socket 370 Keep the P-III, or plug in a Celeron and overclock? The choice is yours.

Vortex 2 Soundcards

A3D AUDIO DONE CHEAP



When it comes to 3D sound, Aureal's A3D 2.0 technology continues to go mano a mano with Creative Labs' Environmental Audio Extensions (EAX). We took a look at two cards that use Aureal's Vortex AU8830 PCI audio chip.

—Bryan Del Rizzo

Montego II Quadzilla

With a name like Quadzilla, this card gives the impression Turtle Beach was honing in on Toho Studios turf, ready to wreak havoc on downtown Tokyo. But with no large lizards in sight, the only thing scary is that a card this cool can be had for a single C-note.

We liked the original Montego II, which scored a solid 8 in the May issue. The Quadzilla adds a much-needed coaxial S/PDIF for quad-speaker output, included on a bundled bracket board.

Luckily, little else has changed. The 320-voice MIDI wavetable engine is still top notch (we especially love the chorus and violin patches). The digital gameport works as promised. And DOS games, if you're into that retro sort of thang, ran too.

Thanks to more-refined drivers, Quadzilla was better able to handle multiple audio streams, of both the 3D and non-3D variety. CPU utilization became an issue when we tried pumping the card with more than 64 audio streams at once, but even then it topped out at around 20%. Gaming under *Descent III* was respectable, but expect a slight performance hit with A3D.

The software bundle includes a nice mix of audio and video utilities, but we were bugged by the inability to access the mixer (which includes settings for both front and rear speakers) from the Windows icon tray, or the need to free up two expansion slots (one for the card, the other for the bracket).

Overall, when compared to Xitel's gaming rig, which includes a powerful pair of force-feedback headphones but no software, Turtle Beach's offering has more in common with Godzookie than with his famous fire-breathing father.

OK, it's not a creature of radiation, but the Quadzilla soundcard is still a good buy.

THE SPECS FOR BOTH

CHIP HARDWARE
- 320-voice wavetable engine
- 10-band stereo graphic equalizer
- A3D 2.0 wavetracing acoustic engine (64 wall reflections)
- PCI bus interface
- DirectSound3D acceleration
- Supports up to 96 simultaneous audio streams

SPEAKER SUPPORT
- Two, four, headphones, S/PDIF

PLUSES
- Low price
- Good performance

MINUSES
- Requires two brackets
- Mixer mumbo-jumbo

MAXIMUM PC VERDICT

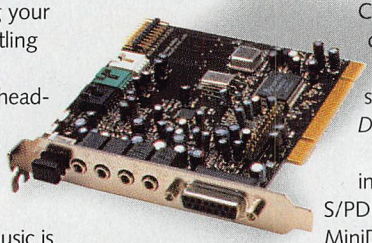
Price $100
Company Turtle Beach
Phone 800.233.9377
URL www.turtle-beach.com

8

Storm Platinum Gamers Pack

A3D technology arguably sounds best when using lobe-covering headphones, and Xitel takes advantage of those funky HRTFs by bundling TacStar's "force-feedback" headphones with a card based on Aureal's quad-support reference design.

Though not truly "force feedback," the TacStar headphones do enhance bass response and truly transform the heavy thump of heavy armor, shaking your nerves and rattling your brain. However, the headphones are better suited for games in which the background music is turned off; otherwise, the sound turns into a mess of low frequency vibrations.



It's based on the same chip, but bundling "force-feedback" headphones helps the Storm Platinum kick Quadzilla's scaly green ass.

The Storm Platinum ran, worked, and sounded fine. However, thanks to less-polished drivers, the card ate up more CPU cycles than the Quadzilla during our DirectSound3D streaming tests, and was slightly slower during our *Descent III* benchmarks.

The Storm Platinum also includes an optical TOSLINK S/PDIF, so connections to a MiniDisc or other digital mixers are a snap. Even better, the S/PDIF and the rest of the audio components are housed together on a single board, so you only have to free up one bracket in your PC.

Unless you really need a coaxial S/PDIF, the Storm Platinum is the way to go. You'll get roughly the same performance, technical features, and game compatibility for the exact same price as the Quadzilla—with a free pair of headphones to boot.

PLUSES
- Single board design
- Cool headphones

MINUSES
- Less-polished drivers
- No software

DARE TO COMPARE

BENCHMARK	TURTLE BEACH'S QUADZILLA	XITEL'S STORM PLATINUM
% CPU UTILIZATION WITH 3D SOUNDS		
16 streams	7%	12%
24 streams	9%	18%
% CPU UTILIZATION (NON-3D)		
16 streams	10%	5%
24 streams	11%	6%
GAME PORT	Passed	Passed
REAL-MODE DOS	Passed	Passed

MAXIMUM PC VERDICT

Price $100
Company Xitel
Phone 888.291.9068
URL www.xitel.com

9

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Spread your wings and fly

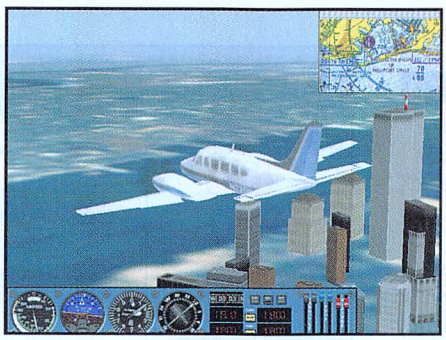
$50,000 AVIATION EXPERIENCE FOR LESS THAN $50

For centuries, man dreamed of achieving flight—now he's got it, but he can't afford it. Enter the flight simulator. The latest batch of flight sims looks better than ever, with stratospheric graphics guaranteed to leave the hottest Pentium III and 3D accelerators gasping for air. So, grab your scarf and goggles—we're taking the latest batch of planes out of the hangar and into the wild blue yonder.

—Frank Lenk

Fly!

Fly! includes satellite-based scenery for San Francisco, Los Angeles, Chicago, and New York, with 3D mountains that look real enough to camp in, and skyscrapers you'll immediately recognize. But the painted turf is ludicrous, even at the max resolution of 1024x768. For example, Alcatraz consists of reasonably detailed buildings seemingly floating in the water. On the other hand, the Photex3 graphics engine delivers the coolest clouds ever, hands own. The sensation of whipping through the puffy bases of a cumulus cloud layer is one of the reasons people actually learn to pilot a plane, and *Fly!* is the first sim to capture that feeling.



That Piper twin looks a bit blurry, and look—Manhattan's been flooded!

PLUSES
- Best clouds ever
- Multiwindow display
- Lots of ATC detail

MINUSES
- Variable performance
- Some graphic ugliness
- ATC AI not very helpful

There's no virtual cockpit in *Fly!*, but you can set up multiple onscreen windows. Air Traffic Control (ATC) procedures are complete, but largely brain-dead. As long as you stay on the expected plan, radio responses are believable—but wander off the ordained path, and the instructions become obtuse. The sim's overall performance is similarly variable, with framerates that drop considerably. Translucent colored lights particularly choke the graphics, so for nighttime flying, turn down visibility for better performance.

THE SPECS
- **3D CARD SUPPORT**: Glide, D3D
- **SOUND SUPPORT**: Direct Sound
- **MULTIPLAYER**: TCP/IP | Internet | LAN

The array of aircraft available isn't exactly dazzling. What's missing is something fun, like a serious aerobatic performer, or a biplane.

Overall, *Fly!* is great for tooling around the circuit, and not bad for instrument navigation. But weak AI, variable performance, and blurry terrain textures keep us from recommending the product as-is for anyone but the hard-core sim fanatic.

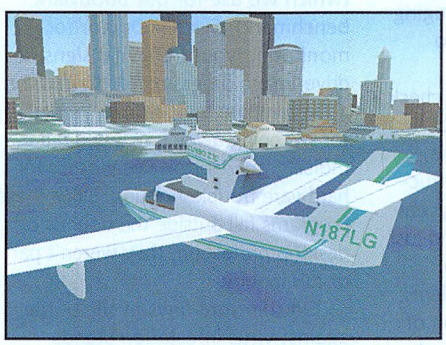
MAXIMUM PC VERDICT

Price $50
Company Terminal Reality
Phone 800.463.4263
URL www.iflytri.com

6

Flight Unlimited III

Flight Unlimited III covers much more ground than its predecessors, but still stops short of covering the world—or even the continental US. The new high-detail area is Seattle, but if you own *FU2*, you can also load your old San Francisco data. Within both areas, terrain is drop-dead gorgeous at 1024x768.



Set this amphibian down on the Seattle waterfront.

PLUSES
- Awesome scenery
- Bitingly accurate ATC chatter
- Wide range of aircraft

MINUSES
- Non-interactive training
- Aerodynamics could be sharper
- Ugly, ugly clouds

The new flight editor can't create new maps or 3D objects, but can add buildings and nav beacons, and lay out entire new airports from scratch. Another new addition, the weather systems simulation, lets you drag fronts around on a weather map, set desired severity, and randomly generate patterns until you get one you like. You're offered two amphibians, but the best plane is the Motorglider, which handles just like a plane with a 60-foot wingspan should handle.

Even on a P-III 450MHz armed with a TNT2 card, framerates dropped into single digits in crowded areas. The new training mode is helpful, but totally non-interactive—the selection of scripted challenges is too short; instruments aren't active in virtual cockpit view; and the surrounding clouds look like big painted cubes.

THE SPECS
- **3D CARD SUPPORT**: Direct 3D
- **SOUND SUPPORT**: Direct Sound
- **MULTIPLAYER**: None

If you've already logged a good amount of time on *FU2*, this sequel won't blow you away, but over time, the graphics, meticulous detail, and selection of aircraft will prove their worth. This season, this is the one civilian sim you just gotta get.

MAXIMUM PC VERDICT

Price $40
Company Looking Glass
Phone 617.441.6333
URL www.flight3.com

8

Defenders of the Desktop

IN THE 90'S, YOU HAVE TO USE PROTECTION

A PC apocalypse can strike at any time. If you're not prepared, you'll be crying like a baby when the blue screen of death takes you on a one-way trip to hard drive hell. So, get smart and get some protection. To help you pick the best armor, we pitted the newest versions of the top utility suites against each other. It's dangerous out there, people—these are the tools that'll keep you safe.

—Josh Norem

Norton SystemWorks 2000

THE SPECS

APPS/MODULES

- Norton Utilities 2000/5.0
- Norton CleanSweep 2000/4.7
- Norton CrashGuard 2000/4.0
- Norton AntiVirus 2000/6.0

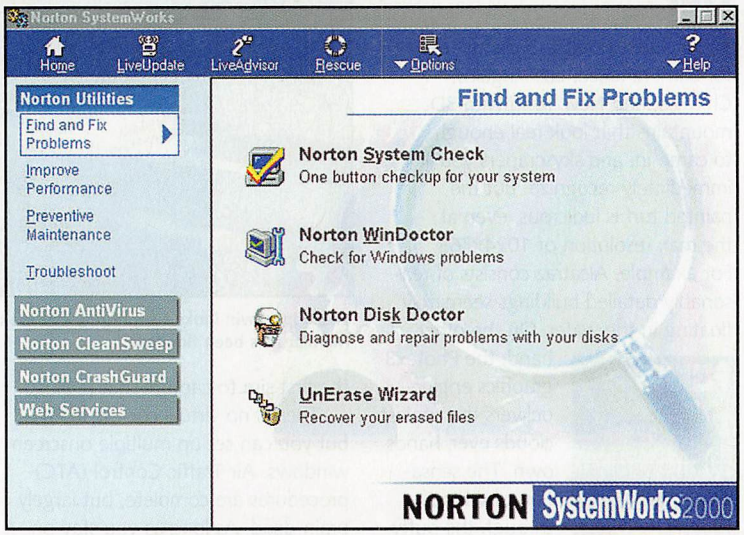
PLUSES

- App integration is extremely well done
- Intuitive controls
- Every program features improvements
- Disk Doctor is a lifesaver

MINUSES

- E-mail virus detection was lacking
- Consumes excessive system resources
- We're tired of looking at Peter Norton's mug on the box

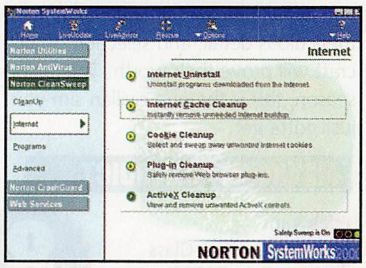
SystemWorks 2000 compiles all Symantec's best products—*Norton Utilities 5.0, CleanSweep 4.7, AntiVirus 6.0,* and *CrashGuard 4.0*—into one easy-to-use package. Although each component in the 2000 suite differs slightly from its stand-alone version, the biggest departure from Norton's norm is a new GUI called the Integrator. Functioning as a command center for every application in the suite, the Integrator is extremely intuitive. It even allows future products to be "snapped" into it—a technological first for office utility packages.



Norton's new Integrator interface acts as a command center and lets future products "snap" into it.

The workhorse of the suite is *Norton Utilities*, a powerful collection of programs that perform disk repair, data recovery, and hard drive optimization. *System Check* leads the charge—in our tests, it reported 55 problems in five categories, ranging from invalid registry sections to incorrect file extensions.

Next, we ran *WinDoctor* to check the Registry and *Disk Doctor* to inspect our drive's partition table, boot sector, file and directory structure, compressed data, and physical surface. Since *System Check* had just given our drive the full workup, neither Doctor found any problems. *Speedisk,* Norton's zippy version of Scandisk, looked at our drive next and found it to be 6% fragmented.



Time to take out the trash.

Nine minutes later, all the sectors were as good as new.

Rounding out the package is a bounty of diagnostic and security programs, including *System Information* (which we use for our bootMark benchmark); *System Doctor* for monitoring your PC's vital signs; a drive-image program; *Registry Editor*; a file compare tool; a drive "wiper" for sweeping away unwanted data morsels; and Norton *Diagnostics* for hardware troubleshooting. Since these programs fall outside the bounds of desktop protection, they weren't part of this inquiry.

On the front lines in the battle against virus infestation stands *Norton AntiVirus 6.0*, which features a new interface, fully customizable scans, fewer system conflicts, and operation wholly within Windows. In manual scans, *AntiVirus* found 33 out of 42 viruses. Compressing the viruses had no negative effect on detection scores. E-mail detection was lackluster, however; we were repeatedly allowed to send, receive, and save zipped viruses to our hard drive.

Batting cleanup is *Norton CleanSweep*, which helps rid your PC of hard drive clutter by clearing out duplicate files, Internet junk, cache leftovers, and Registry dust bunnies. *CleanSweep* also uninstalls programs without leaving data fragments scattered about your hard drive.

As a safety net, *SystemWorks* includes a fourth utility, *CrashGuard 2000*, which is both useless against a hardcore Windows crash and greedy with system resources in exchange for constant protection. Our test system's resources hovered around 75% with the default monitors running.

Resource issues aside, we have no trouble recommending *SystemWorks*. If you want top-notch protection, or are just paranoid about drive corruption, pick up *SystemWorks* and rest easy knowing you have the best utility software on the market.

MAXIMUM PC VERDICT

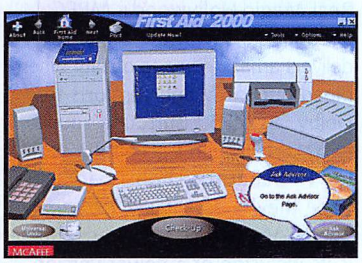
Price $60
Company Symantec
Phone 800.441.7234
URL www.norton.com

McAfee Office 2000

Network Associates deserves credit for cramming every utility known to man into *McAfee Office 2000*. Unfortunately, the result is a classic case of quantity outweighing quality. The package offers seven titles, including *VirusScan 4.02* and *Nuts & Bolts 98 2.03*—which received an 8 and a 9/Kick Ass respectively in past *Maximum PC* reviews—as well as *FirstAid 2000 6.02, Y2K Survival Kit 1.0, Uninstaller 5.12, Oil Change 2.5*, and *Virtual Office 1.0*. The *Y2K Survival Kit* and *Virtual Office* (for publishing HTML) are both new to the suite, as is the Central interface, which lets you install and update all the programs as a group instead of one at a time, as in the last version.

Nuts & Bolts drove us nuts with too many options.

To test *McAfee*, we loaded the same drive image that we used to test Norton. We ran *Nuts & Bolts* first. Its *PC Checkup* module found 35 errors in 11 categories, ranging from missing shared DLLs to the thoroughly ridiculous "Windows animation is enabled." We made the suggested changes, then were forced to reboot in order for the changes to take effect.



Pick the ailing peripheral and McAfee applies first aid.

Next on our list was *DiskTune*, which reported that our hard drive was 5% fragmented. We promptly ordered a defragging, and after a grueling 22-minute scan, everything was back in order. From there, we headed to the cleanup section, hoping to free up a bit of hard drive space. Unfortunately, the *Cleanup Wizard* wouldn't let us select a hard drive for inspection, even after rebooting, then trying it on a different machine. *McAfee* offers a patch on its web site for this problem. After downloading and installing it we were able to select our hard drive, but the program still couldn't complete the cleaning operation. Disgruntled, we turned to the *Registry Wizard*, which told us there were no errors in the Registry. Knowing there had to be an error somewhere in the Registry, we loaded *DiskMinder* to scan the hard drive's surface. That program also reported no errors, but it did find 88 orphaned files and promptly sent them home to their parents. *Nuts & Bolts* contains other specialty programs that perform various useful tasks such as file shredding and encryption, but it's also loaded with antiquated apps—such as *Launchpad* (picture Windows 98's Quicklaunch taskbar) and *EzSetup*made for Windows 95)—that are so dated they aren't worthy of inclusion in a year 2000 suite.

The next app we ran through the gauntlet was *McAfee VirusScan*, which received an 8 verdict in our August issue. In the first battery of scans, *VirusScan* caught 36 out of 42 viruses in our test folder, three more than *Norton* identified. But scanning the same files using the engine built into Central detected zero viruses—it turns out that the Central interface cannot look inside compressed files. Next, we tested e-mail detection, and *VirusScan* performed impressively. Although we successfully sent a folder containing 42 zipped viruses, when the file came back, *McAfee* not only stopped its transmission, but also found 41 of the 42 viruses attached to the inbound e-mail.

The rest of the apps in the suite perform essentially the same functions as *Nuts & Bolts* and *VirusScan*, with the exception of *Oil Change*, which automatically updates your software via the web, and the WYSIWYG HTML editor *Virtual Office*. While we applaud the massive assortment of tools *McAfee* managed to squeeze into *Office 2000*, they were more redundant than constructive.

THE SPECS

APPS & MODULES

- Nuts & Bolts 98
- McAfee VirusScan
- Oil Change
- Virtual Office
- Uninstaller
- First Aid 2000
- Y2K Survival Kit

PLUSES

- VirusScan offers Fort Knox–like protection
- Nuts & Bolts includes many useful programs

MINUSES

- No virus detection for compressed files in Central interface
- Dated look and feel

DARE TO COMPARE	NORTON	MCAFEE
Errors found on HD	55	35
Fragmentation	6%	5%
Time to defrag	9 minutes	22 minutes
Viruses found	33 out of 42	36 out of 42
Zipped e-mail viruses found	0	41 out of 42
Space reclaimed with sweep	56K	0K
Average resource level	75%	67%

Both systems were tested on a Dell T500 with 128MB PC100 SDRAM, a 13GB Ultra DMA hard drive, TNT2 3D graphics board, and Windows 98. The scores reflect how both suites performed on the same drive image loaded before each battery of tests was initiated.

MAXIMUM PC VERDICT

Price $60
Company Network Associates
Phone 408.988.3832
URL www.mcafee.com

7

Pioneer DVD-114

DVD HITS DOUBLE DIGITS

Whatever it is that Pioneer is doing, it's doing it right. The company continues to release the world's fastest DVD drives one after another, with seemingly no competition. Though we can't prove that Pioneer's engineers are taking steroids or other performance-enhancing substances, we have irrefutable proof that the company's buff new 10x DVD drive is on something—speed.

Pioneer's DVD-114 ups the DVD ante to 10x.

Pioneer's new DVD-114 drive is here, and it's the fastest we've ever benched. When put through the rigorous DVD/CD Tach wringer, the 10x DVD-114 spanked the benchmark scores held by its predecessor, Pioneer's 6x DVD-103S. In sequential read tests taken from nine disk locations, the DVD-114 was greased lightning, delivering up to 11.1MB/sec (8x) for DVD data and 5.3MB/sec (35x) for CD data.

It's worth noting that the DVD-114 is a full CAV drive, so it reaches its maximum read capacity at only the outer edges of the disc. Unfortunately, most CD and DVD discs aren't full to the brim with data, so the drive rarely hits its peak capacity. Still, its performance is the fastest on the market, so we're not complaining. Pioneer also toned up the DVD-114's access times, shaving more than 60 seconds off the full-stroke access score posted by the 6x drive. Full-stroke access tests measure the drive's seek performance by reading data spread across the entire disc—a worst-case scenario for a drive trying to locate specific information.

In CD-ripping tests, the 10x drive performed impressively, converting CD audio into WAV files at 12x. But because many people rip songs directly to MP3s (for backup purposes, of course), we created a new benchmark to measure the drive's bootleg—sorry, its backup prowess. The DVD-114 blew through our White Zombie test CD, creating MP3s of all 12 tracks in only 9:52 minutes—just enough time to read the copyright information on the CD's liner notes.

Of course, DVD-ROM drives aren't used just for data transferring; they're also for movies. Both Hi-Val and Utobia, the two distributors selling the DVD-114, include the Real Magic Hollywood+ MPEG decoder card with their kits. It delivers amazing image quality when piped out to TV and supports true Dolby Digital 5.1 surround sound.

You really can't go wrong with the Hi-Val or the Utobia packages, since they're essentially the same. The Hi-Val bundle's only advantage is its inclusion of a newer version of the Hollywoood+ card (dubbed "B1"), but this just translates to improved monitor image quality. For those who already own an MPEG decoder, Hi-Val sells the DVD-114 without the Hollywood+ card and has plans for a SCSI version that should be available by the time you read this.

—Josh Norem

THE SPECS

INTERNAL BUFFER SIZE	
512K	
INTERFACE	
Bus-mastering ATAPI (EIDE) I Ultra DMA/33 Mode 2 I SCSI	
FRONT PANEL	
Load/eject button	
Busy LED	
3.5 mm stereo headphone jack	
Rotary volume control knob	
MEDIA SUPPORTED	
DVD single-layer and dual-layer I DVD-R and DVD-RW (read only) I CD-ROM Mode1 I CD-ROM XA Mode 2 I Kodak Photo CD I CD Extra, Video CD I CD-DA I CD-R I CD-RW (read only)	

PLUSES

DVD-ROMs don't get any faster

Hollywood+ MPEG decoder rules

MINUSES

Random access is a tad slower

DARE TO COMPARE

DRIVE MODEL	PIONEER DVD-114
Advertised DVD-ROM/CD-ROM speed	10x/40x
DVD TACH BENCHMARKS	
Drive rating	5.6x[1]
Min/Max 32K sequential read (MB/sec (drive rating))	5.5 (4x)/13.3 (9.8x)
Full stroke/random access times (ms)	186/95
1x/2x/4x CPU utilization	7%/14%/28%
2K/8K/32K burst speeds (MB/sec)	3.2/10.2/20.6
CD TACH BENCHMARKS	
Drive rating	23.7x[2]
Min/Max 16K sequential read (MB/sec (drive rating))	2.3 (15x)/5.3 (35.3x)
Full stroke/random access times (ms)	157/78
4x/8x/12x/40x CPU utilization	5%/8%/12%/33%
2K/8K/16K burst speeds (MB/sec)	3.6/9.9/14.1
REDBOOK AUDIO EXTRACTION **	
Extraction speed / time (min:sec)	12.4x/6:53
REAL-WORLD BENCHMARKS	
Time to copy 646MB **Maximum CD 07** (min:sec)	00:05:06
Time to copy 4.34GB **National Geographic single-layer DVD-ROM** (min:sec)	00:11:14

[1]32K weighted average. [2]16K weighted average.
** Performed real-world captures using Xing Technologies' Audio Catalyst.

MAXIMUM PC VERDICT

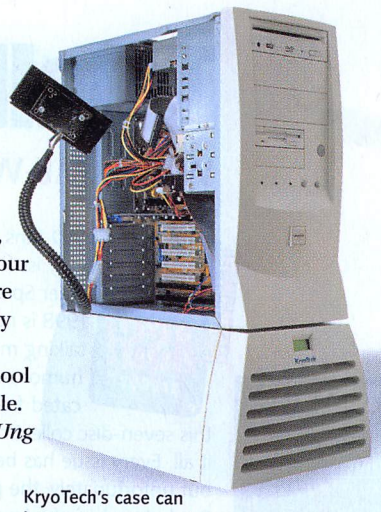
Price $149 without card; $199 for full kit
Company Hi-Val
Phone 714.953.3000
URL www.hival.com

Price $179
Company Utobia
Phone 888.488.6242
URL www.utobia.com

9

Keeping it Cool

TWO TOOLS THAT'LL HELP YOUR PC BEAT THE HEAT



If you think you're suffering during Indian summer, imagine what it's like inside that sweatbox you call your PC. If you're burning a CD-R or cooking pixels with a Voodoo^3 or TNT card on a 100° day, you can easily expect the temperature inside your PC to hit 130° Fahrenheit. You'll never really know how hot your system is unless you actually check its temperature, but anything above 120°F is pushing into the danger zone. If it gets any hotter than that inside your case, you have a serious problem, Sonny Jim. Excessive heat can make your memory unreliable, cause spontaneous reboots, and even kill your hard drive. Here are some handy gadgets that'll keep your PC cool and comfortable.

—Gordon Ung

KryoTech Renegade

KryoTech is known worldwide for creating crazy cooling systems that would make any snowman happy. Using an "evaporative phase-change" system, this KryoTech case pushes temperatures down to 27° Celsius, or about 80.6° Fahrenheit. That's not the 40-below treatment that KryoTech gives its top-end cases, but those cases require special motherboards to handle condensation problems. While 80° might not seem cold, it's an impressive temperature considering the amount of heat that today's PCs generate.

PLUSES
As cold as you can get without condensation issues

MINUSES
Not enough drive bays
Cold plate tether difficult to bend

We looked at the ATX-PE, the Slot 1 edition of the Renegade. (Socket 7 and 370 versions are also available.) The PE includes an integrated temperature display on the front bezel and a thermal-guard that shuts down the system when the internal temperature rises above 131°F. A massive "cold plate" with a thick thermal bus bolts onto your CPU. The Renegade comes with its cooling unit ready to rock, but you'll have to buy your own mobo and power supply. Be aware: Some P-III CPUs may require you to drill out bolts in order to remove the heatsink.

We built our box with a Soyo 6BA+III, a 450MHz Pentium II, and an STB nVidia TNT card. While KryoTech says the cooling should be sufficient to overclock by about 10%, we could tick the 450MHz up to only 472MHz (but this limitation can be attributed to the CPU, not to lack of cooling). With room temperatures of 74°F, the KryoTech managed to hold temperatures to 71°F and even achieved a chilly 57.2°F. We unplugged the Renegade to see how fast the temperature would rise; within 10 minutes, the P-II hit 117°F and continued to climb until we turned the KryoTech back on.

KryoTech's case can keep your setup cool and comfortable.

Our main gripes are with the size of the case. With just three 5.25-inch and two 3.5-inch external bays, the KryoTech will fall short for drive-bay freaks. We also dropped screws into the cooling unit by accident, because the bottom of the case isn't completely sealed.

Despite these minor glitches, the Renegade fills the bill for those who want the ultimate in cooling but want to avoid submerging their system in mineral oil or storing it inside a refrigerator.

THE SPECS

FEATURES
Supports SECC, SEPP packing
Accommodates ATX, Mini-ATX, and Micro-ATX motherboards

MAXIMUM PC VERDICT

Price $409
Company KryoTech
Phone 803.926.0066
URL www.kryotech.com

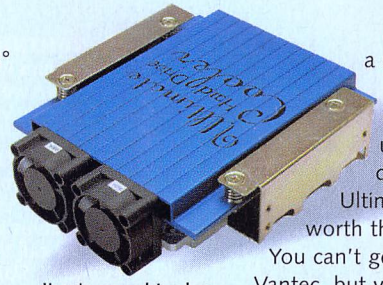
9

Vantec Ultimate Cooler

Although Vantec calls it the "Ultimate Hard Drive Cooler," we prefer the name "Big-Ass Hard Drive Heatsink." The aluminum unit absorbs heat and the two fans push hot air out the front of your PC. For our test, we taxed a Seagate Cheetah 18GB Ultra2 SCSI drive by copying *Office 2000* 50 times. Then we measured the temperature of the hard drive. In a mid-tower Micron system, the surface of the Cheetah hit 108.5°F, or 33° above room temperature. With the Ultimate Cooler, the temperature never climbed above the ambient case temperature of 80°F. Unfortunately, because our case lacked the proper holes, we couldn't attach the faceplate to the drive bay. Actually, we preferred the industrial look of the exposed fans spinning away.

PLUSES
Ridley-Scott styling

MINUSES
Eats available 5 1/4-inch hard drive



It eats up a drive bay, but with the Vantec Ultimate Cooler your hard drive's got it made in the shade.

If you have a spare drive bay and a lot of cash tied up in hard drives, the Ultimate Cooler is worth the investment. You can't get it directly from Vantec, but you can contact the distributor, Atacom, at 510.226.9596.

THE SPECS

FEATURES
Dual 40x40x20mm fans
MTBF: 42,000 hours

MAXIMUM PC VERDICT

Price $30
Company Vantec
Phone 510.668.0368
URL www.vantecusa.com

8

Totally Mad

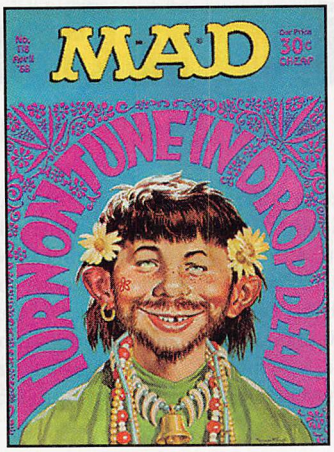
WHAT, ME WORRY?

MAD fans, rejoice! Thanks to Broderbund, every issue of *MAD* magazine (including the Super Specials) printed from 1952 through 1998 is now just a mouse click away. We're talking more than 22,000 pages of the best humor mag your schoolteachers ever confiscated from you. There's so much material in this seven-disc collection, we needed days to plow through it all. Every issue has been scanned from cover to cover, but unfortunately, the page-compression scheme that Broderbund used introduced noticeable artifacts. While the material is still readable, the artifacting becomes painfully apparent when you zoom in on a page.

Fortunately, Broderbund included a raft of cool features, such as a searchable database that catalogues work by writers' and artists' names, WAV files of every song ever recorded on those plastic flexi-disk records (remember *Disco Clap*?), every fold-in (they're fully animated!), and enlightening video interviews with the "Usual Gang of Idiots."

While at first glance this collection looks like the end-all-be-all for *MAD* fanatics, we noticed some glaring omissions. You won't find a detailed history of the magazine, and you won't learn much about the lives of your favorite writers and artists. Nor will you find the origins of running jokes such as the MAD blimp, Arthur (the plant), Flip (the bird), or where the expression "FA!" came from. Aside from these few quibbles, and the fact that the collection comes on seven CDs instead of one DVD, *Totally MAD* kicks some serious ass.

—Rick Popko



If you read one issue a day from this MAD collection, it would take a year and 199 days to read them all.

PLUSES
- Incredible amount of content
- Extremely humorous
- Good search engine

MINUSES
- It comes on seven CDs
- Lacks history of MAD
- Lacks bios of writers and artists

THE SPECS

WHAT YOU GET
- 500 issues (includes Super Specials)
- 22,000 pages
- Seven CDs
- 50 years of material

MAXIMUM PC VERDICT

Price $70
Company Broderbund
Phone 888.829.3343
URL www.broderbund.com

9

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Cambridge Desktop Theater 5.1 $259
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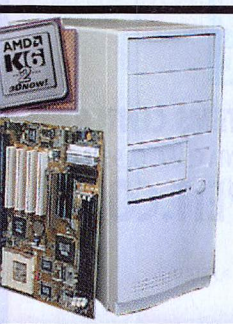

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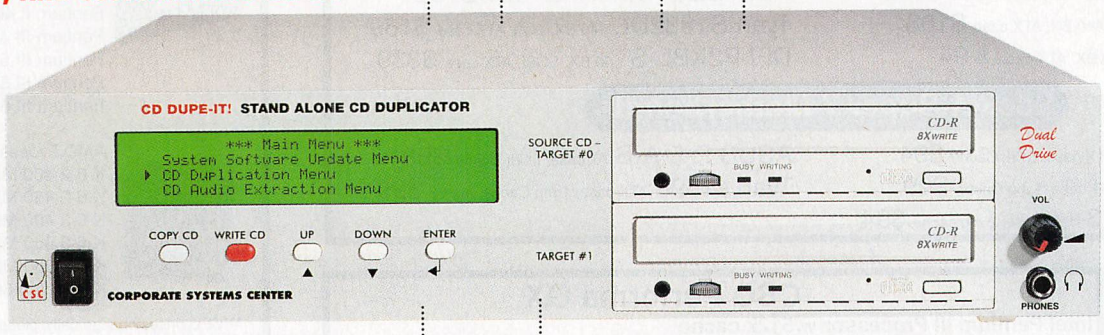

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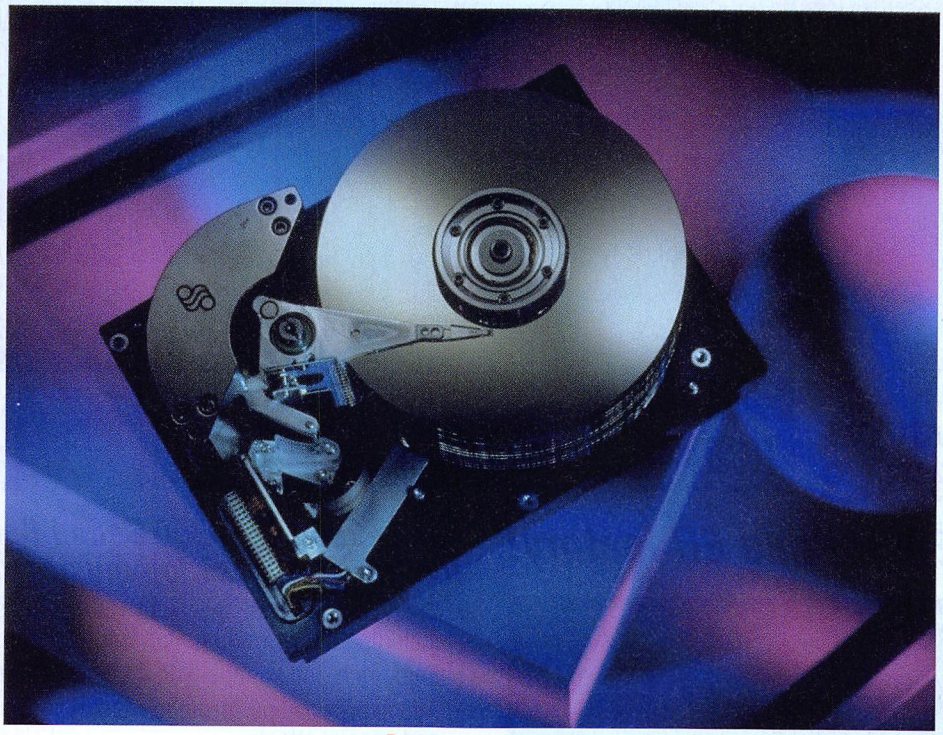

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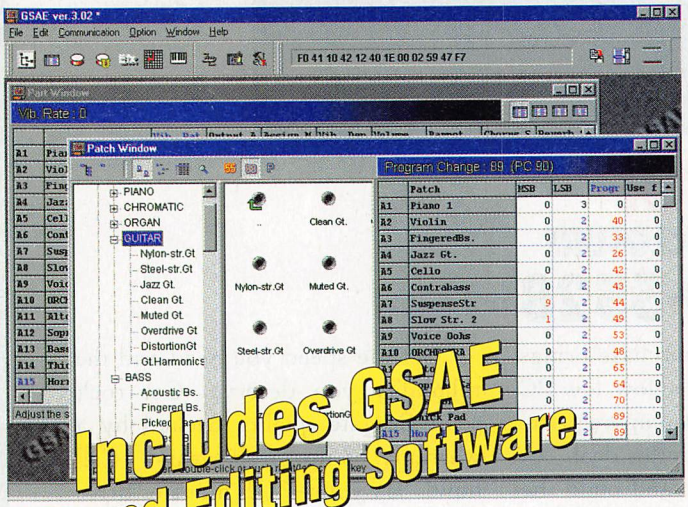

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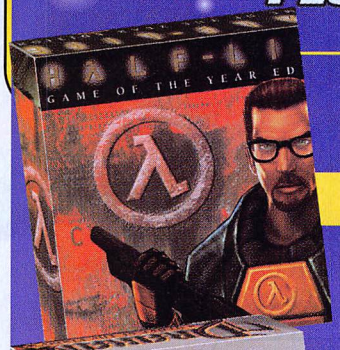

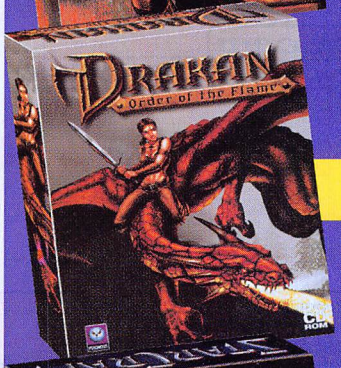

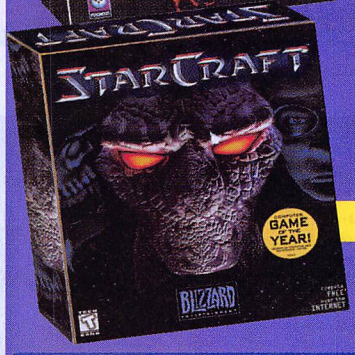

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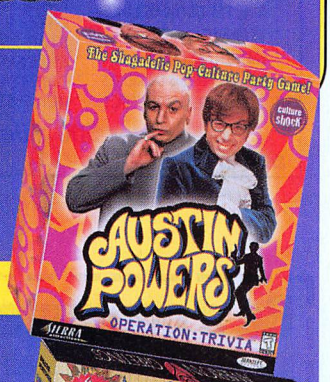

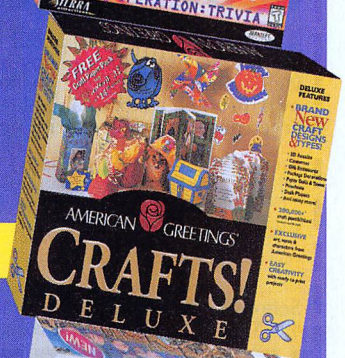

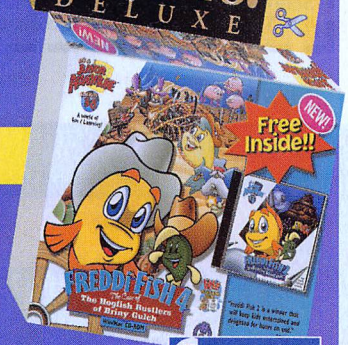

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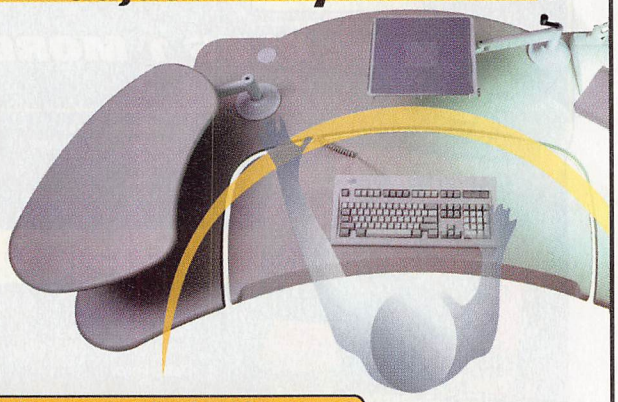

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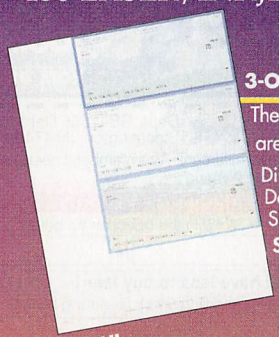

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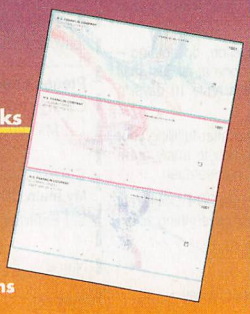

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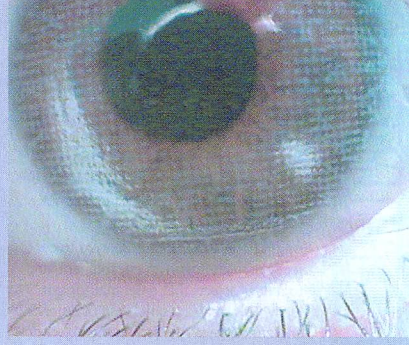

Tech Terms Revealed ▶

Technical terms found throughout MAXIMUM PC are underlined and in blue. Hyperlink back to here for revelation and further explanation. Terms appearing in **blue** within the Terminator are updated definitions of previously explained concepts.

A

accumulation buffer: an additional buffer that accumulates multiple renderings of a scene and integrates them for fancy visual effects. Accumulation buffers such as 3dfx's T-buffer are used primarily for full scene anti-aliasing since they can combine multiple snapshots of source image data to yield better overall visual quality.

Accelerated Graphics Port AGP is an expansion bus developed by Intel specifically for the videocard subsystem. It operates independent of the PCI bus and normally runs at 66MHz (i.e., 1x). When you see multipliers attached to AGP, such as 2x or 4x, they refer to how much faster the bus will run—2x means 66MHz x 2, or 133MHz.

alpha-blend Assigning an alpha transparency value to a pixel and blending it with the background scene to create invisible, or partially transparent, effects The process is often used in games to depict special effects, such as explosions and weapon discharge. When applied to polygons, alpha-blending can simulate semi-transparent objects, such as water and glass.

Alpha channel In 32-bit color, 8 bits of data that are used as a separate layer to represent levels of translucency in an object.

Anti-aliasing A technique that smooths the edges of diagonal lines on the screen. Without anti-aliasing, diagonal lines often have a "jaggy" appearance caused by the stair-step effect of the pixels. Anti-aliasing blurs the edges of the lines. In 3D graphics, bilinear and trilinear filtering provides anti-aliasing for textures.

anisotropic filtering Conventional texture filtering techniques do not compensate for anisotropy—the elongation of the screen pixel when it is mapped into texture space. This results in either blurring or aliasing, depending on the choice of texture level-of-detail. To achieve sharp textures, a card can use anisotropic filtering, a process that involves an elliptical kernel whose shape and orientation depends on the projection of the destination pixel onto the texture map.

API Application Programming Interface. A collection of subroutines—usually part of an operating system—that application programs call upon to perform common tasks. For example, a program might call an API routine to display a window on the screen. APIs reduce the amount of code programmers have to write.

areal density The amount of data that can be packed onto a storage medium. Areal densities are generally measured in gigabits per square inch. Generally, the higher areal density, that is, the more data that can be packed into a single square inch, the better.

ATA/66 An enhanced version of the IDE I/O interface that supports 66MB/sec.

B

BIOS Basic Input/Output System. Software that contains your computer's most rudimentary instructions on how the operating system communicates with hardware. Your BIOS runs at startup, configures devices, and then boots the OS. Because the BIOS is so integral to getting your computer started, it's stored on a separate ROM chip, not your hard drive, to isolate it from crashes.

Bump-mapping A visual trick that attempts to simulate a texture's roughness or smoothness, depending on how the texture reflects lights. In 3D, this is usually accomplished by laying two textures onto a polygon--a base texture for the graphics, and a second displacement texture that is mapped on the object. This second texture determines how "rough" the surface will appear.

bus An electrical pathway over which the components inside a computer communicate with each other. There are many types of buses, including the PCI bus (which supports PCI slots) and the system bus (through which the microprocessor communicate with the rest of the system).

BX Short for 440BX, an Intel core-logic chipset that supports a 100MHz system bus and 100MHz SDRAM.

C

CAD Computer-aided design. The process of designing something on a computer, rather than on a paper-and-pencil drawing board. Most CAD work is done on powerful workstations, although high-end PCs are encroaching on this market.

Camino/820 Intel's latest consumer-level core-logic chipset ("Camino" is the internal Intel codename; Intel 820 is the official designation). The chipset supports AGP 4x, ATA/66, a 133MHz system bus, and Direct RDRAM memory.

Central office A telephone communications term. The central office (CO) is an office in a locality to which subscriber home and business lines are connected on what is called a local loop. The central office has switching equipment that can switch calls locally or to long-distance carrier phone offices.

CGDC Computer Game Developers Conference. An annual gathering of electronic entertainment companies, gaming hardware vendors, and the developers that love them.

co-axial S/PDIF see S/PDIF

command turnaround The turnaround time a computer takes between the commands it issues to the drive. This command turnaround time—during which the bus remains idle—is essentially overhead and constitutes a very significant portion of the overall time available on the bus.

Coprocessor A microprocessor chip that assists the main microprocessor in a computer, usually by handling some specialized task such as graphics.

D

DHCP Dynamic Host Control Protocol. DHCP is used to dynamically assign IP addresses to machines. Utilizing a DHCP server greatly decreases the workload of Windows NT administrators, since it automatically assigns all the TCP/IP information required by a machine. It also allows them to manage their entire collection of IP addresses in one place. You may be familiar with the infamous Windows message that asks "Obtain an IP address from a DHCP server?"

Digital loop carrier A fiber-optic-based device used to link neighborhoods to the telephone system as a cheaper alternative to copper phone lines. A DLC is also known as a pair gain system.

DIMM Dual Inline Memory Module. A DIMM is a RAM module configuration that allows dual channels to be used in a single interface. On a motherboard's, that would be dual 32-bit memory paths forming a single 64-bit path. Before DIMMs, RAM modules came in SIMMs (Single Inline Memory Modules), which provided a single 32-bit path. With most SIMM motherboards, memory modules needed to be installed in pairs. DIMMs can be installed individually. DIMMs tend to be faster and hold more memory than their SIMM counterparts.

Direct3D A subset of Microsoft's DirectX API. This interface allows developers to use hardware acceleration for 3D graphics, which helps games run faster by offloading the 3D processing onto a dedicated piece of hardware.

DirectInput Falls under the umbrella of Microsoft's DirectX, an API used by developers to create great games. DirectInput in particular allows for better mouse and joystick interactivity.

Direct RDRAM Rambus Dynamic Random Access Memory. It's a proprietary but widely licensed memory standard controlled by Rambus that transfers data much faster than current standards such as EDO RAM and SDRAM. The latest incarnation, Direct RDRAM, supports transfer rates as high as 800MHz, compared to 66MHz for EDO RAM and 100MHz for SDRAM.

DirectX A collection of APIs developed by Microsoft. This driver model helps create a unified multimedia platform on PCs. Parts include Direct3D, DirectSound, DirectInput, DirectDraw, and DirectPlay. Multimedia developers can write to the standard DirectX API instead of writing to individual hardware APIs and know hardware that supports DirectX will work. It also allows graphics apps to take advantage of hardware acceleration supported by graphics accelerators.

Dithering When an image's color depth is lowered from a higher count to a lower count, it is said to be dithered down. When this happens, any lost color data may be seen by the naked eye as dotted patterns or extraneous artifacts.

DNS Domain Name System. This name-resolution software enables users to locate by domain name computers that are on the Internet or on a UNIX network. A DNS server holds a database of domain names and their matching IP addresses.

DOCSIS Data Over Cable Service Interface Specification. A standard that govern sdata transferred by cable TV.

DRDRAM Direct Rambus Dynamic Random Access Memory. Also known as RDRAM, it's a proprietary but widely licensed memory standard controlled by Rambus that transfers data much faster than current standards such as EDO RAM and SDRAM. The latest incarnation, Direct RDRAM, supports transfer rates as high as 800 MHz, compared to 66 MHz for EDO RAM and 100 MHz for SDRAM.

DSLAM DSL Access Multiplexor A central office (CO) device that enables the provision of ADSL service by allowing and meshing both voice traffic and DSL traffic on a user's DSL line. DSLAM recognizes and separates incoming phone and data signals, directing each to the appropriate network.

E

EAX Environmental Audio. Creative Labs' proprietary 3D sound algorithm based on reverb.

EDO Extended Data Out Random Access Memory. Low-cost memory that loses data if it's not recharged regularly (known as refreshing).

Environment mapping A texture effect that applies a reflection of the surrounding game environment on the texture itself. This is useful for giving textures a highly reflective appearance, such as simulating chrome.

F

Firewall A software system that isolates a network (such as an internal corporate intranet) from the rest of the Internet, permitting only specific data to pass in and out.

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The extended Terminator (with terms not found in this issue of the magazine) is found 24/7 online.

floating point A fractional number, such as 9.95 or 98.6. Computers have a more difficult time working with FP numbers than they do with integers (whole numbers), but the higher precision of FP is required for some operations.

Fogging The ability for a videocard to correctly simulate fog in an environment, and to render objects that enter that fog correctly. This creates a simulation of distance and atmosphere--the farther the object or terrain is, the higher likelihood it will be enveloped in fog.

Frame buffer A block of memory for temporarily storing information displayed on the screen. Graphics cards usually have a few megabytes of fast memory for this purpose. The larger the frame buffer, the more resolution and colors a computer can display.

G

Giant magneto-resistive In 1988, scientists in France and Germany discovered that certain thin-film sandwiches had very large magnetoresistance, which they termed "giant magnetoresistance." But their structures were laboriously built and required extremely low temperatures and high magnetic fields. IBM scientists discovered ways to use standard manufacturing techniques to make GMR structures that had much greater MR at room temperature and low fields than the sensors used in MR heads. In 1997, IBM introduced the GMR head, in which a GMR sandwich replaced the MR element and continued the spectacular increase in disk drive densities and capacities.

Glide 3dfx's proprietary programming interface (API) for its Voodoo family of videocard accelerators. It's usually faster and easier to program for than Direct3D.

Gordon Mah Ung Soft-spoken investigative reporter/conspiracy thoerist/all-knowing tech guru whose goings-on are often shrouded in mystery. Also a purveyor of strange but unusually popular gelatinous snacks.

Gouraud-shading A method for making 3D objects in computer graphics appear naturally lighted. The computer calculates a lighting effect for each polygon vertex and interpolates the results across the entire face of the polygon.

Head end A communications system's point of origin. The head end of the system run by an ISP is the company's computer system and databases.

HRTFs Head Related Transfer Function. Filters applied to sound to simulate 3D positional sound. Created through analysis of how humans perceive sound with two ears.

I

IEEE-1394 The formal name for FireWire, a high-speed peripheral bus developed by Apple and widely licensed to other companies. Since it was adopted as a worldwide standard, IEEE-1394 became the official name. Some digital camcorders and high-end PCs have FireWire ports.

Polygon A 2D figure (usually a triangle or rectangle) that's the building block of a 3D screen object. It usually takes hundreds or thousands of polygons to form the skeleton of a 3D object.

M

Mip-mapping Technique used to generate scaled texture maps that involves creating sub-images sized for every inverse power of two, i.e. 1/4, 1/16, 1/32, etc. The process of creating a mip-map takes time, and larger textures will require longer.

Multitexturing The process of applying multiple textures to polygons in a model. This is usually done by performing multiple texturing passes (called blending) until the image is completed.

N

NetBEUI NetBIOS Extended User Interface. A networking protocol used by Windows For Workgroups and Windows NT.

Network Address Translation or NAT. (Network Address Translation) NAT enables a network of computers to present itself to the Internet using just one IP address. NAT converts the address of each machine on the network into the one IP address that's used on the Internet, then converts information from the Internet and sends it back to the proper computer on the LAN. NAT also acts as a security firewall by hiding the IP addresses of each computer on the network.

Nodes Any computer connected to a network is referred to as a node.

Q

Quadrilateral texturing A method of applying lifelike surfaces to 3D objects rendered in computer graphics. See textures or texture mapping.

P

processing pipeline The path through which data passes in a CPU or graphics processor; The larger the bandwidth (i.e., 128-bit versus 64-bit) the more data the processor can handle.

protocol A formally defined way to perform an action. Diplomatic protocols specify how to greet foreign dignitaries; computer protocols specify interactions between computing devices and programs. For example, HTTP (hypertext transfer protocol) defines how web servers and browsers should exchange data over the Internet.

R

Regional data center The place where all the local head-ends are aggregated in order to go out onto the cable provider's backbone to visit the Internet. In the Bay Area, there is only one RDC, which is located in Santa Clara.

Render farm A collection of powerful computers that render 3D graphics too complex to be drawn in real time. Movie studios use render farms to generate professional-quality animation for output to film. The networked computers often run day and night to create a few frames of high-quality graphics.

RTS Realtime Strategy. As opposed to turn-based strategy games, realtime strategy games such as Command & Conquer

S

SDRAM Synchronous Dynamic Random Access Memory. A faster type of memory that synchronizes with the CPU. Its architecture allows it to handle the 100MHz system bus.

server-class product A computer whose specs and technologies—such as Alpha or Xeon processors—are ideally suited for use as a server. Servers can provide many functions from managing file allocations and file sharing over a network or Intranet, or singular tasks such as managing network printers or databases.

Shannon Limit For any kind of data transmission, there is a theoretical limit to the transfer speed beyond which the signal-to-noise ratio becomes so low that no useful data can be extracted. A modem's theoretical maximum transmission speed under such conditions is in fact around 33.6Kbps.

SIMM Single Inline Memory Module. A RAM module that provides a single 32-bit path. See DIMM.

single cycle Usually associated with 3D rendering. Think of pixel processing as being like a conveyer belt, where the pixel data goes down the line and is given attributes along the way (such as color, level of transparency (alpha), positioning in the z-axis, lighting, and so forth). A single rendering cycle is just such an operation, with the final output being sent to a rasterizer, where it is displayed on screen. Certain attributes, such as bump mapping, environmental reflections, or lighting, may require a second run through this pipeline before heading off into the rasterizer for display. This second run down the conveyer belt is time-consuming and processor-consuming. If a 3D accelerator has a second processor that applies that second attribute alongside all the other attributes during that first cycle, the pixel can be processed in a single-cycle, thus speeding up the process.

single-pass see single cycle

SLI Scan Line Interleave. A term used when two videocards work in tandem, with one videocard rendering the odd lines of a video output, while the other card renders the even lines. It dramatically increases speed but at the cost of more hardware. With the 3dfx Voodoo2, the slave 3D card will send its rendered output via a ribbon cable into the master videocard, where the combined output is then generated on screen by the master card. Having two videocards work as one raises overall rendering performance, and in the Voodoo2's case, allows a higher rendering resolution to be obtained.

S/PDIF Sony/Philips Digital Interface. A standard interface for sending digital audio data. Soundcards with S/PDIF jacks let you use your computer as a mini recording studio.

SSE Streaming SIMD Extensions. A set of 70 instructions from Intel that speed up the Pentium III's floating-point, integer, and memory streaming power. SIMD stands for Single Instruction Multiple Data. This processing strategy tells a single programming instruction to perform the same operation on two or more pieces of data. SSE is similar to AMD's 3DNow! but brings more to the table via memory streaming enhancements. As is the case with 3DNow!, games and applications must be optimized for SSE to take advantage of the performance boosts.

Static IP addresses IP addresses that are permanently assigned to either a client machine or the server of a TCP/IP network—though a static IP address is usually assigned to the server.

Streaming SIMD extensions See SSE

T

Texels Short for TEXture ELement. Refers to the individual pixel that makes up a bitmapped graphic that is used as a texture when it's applied on a polygon.

Textures The surface graphics on a 3D object. Without textures, 3D objects look like naked skeletons of polygons. Textures add realism -- a brick wall, the skin of a lizard, or the gleaming metal surface of a spaceship. A 3D program stores a texture as a graphics pattern and applies it to the structure of polygons.

Texture mapping The process of applying textures to 3D objects in computer graphics.

These The word right before Theseus in Webster's New World College Dictionary. That old Webster… what a card he is!

U

Ultra DMA Ultra Direct Memory Access. The fastest IDE protocol for connecting hard drives and removable storage devices. Capable of 33Mbps throughput.

USB Universal Serial Bus. A new, faster, digital I/O port proposed by Intel for motherboards. Taking up far fewer resources, this port can act as a serial, parallel, mouse, keyboard, joystick, and even speaker interface. Unlike other communication ports on a PC, USB can be daisy-chained up to 127 devices.

V

V.90 A 56K modem designed for connections that are digital at one end and only have one digital-to-analog conversion.

VC133 The official spec for Virtual Channel SDRAM memory running at 133MHz. VC memory modules use a small amount of superfast onboard cache to act as a buffer for the main SDRAM.

Vertex An end point that defines a corner point in 2D or 3D space.

Video memory Temporary memory that a processor or coprocessor uses to display graphics on the screen. Usually this memory consists of several chips on the graphics card. It's not counted as part of a PC's main memory (RAM).

Virtual paths Configuration entries that contain server location information specific to your PC and ISP. Without this information, your PC can't access the web.

W

Workstation A powerful and expensive desktop computer used for professional design work or other demanding tasks. Most workstations have RISC processors. Leading vendors include Sun, SGI, and Hewlett-Packard.

Z

z-buffered In a 3D videocard, local video memory is often used to form a frame-buffer, which stores all sorts of data required by a 3D card in order to properly render a scene onto your monitor. With the advent of texture-mapped polygons interacting in a 3D world in realtime, the need to have a buffer with which to track positioning became a necessity. A z-buffer stores the z-axis value (front to back) of a pixel on-screen--this value is compared with incoming z-value data to determine whether the pixel will be drawn or not, and how overlapping pixels will be presented. How accurate a z-buffer is dependent on how the 3D accelerator handles z-buffer calculations, and how much memory is allocated to it. Higher color-depth rendering requires more z-buffer memory, as the amount of pixel information is made larger with more color usage. It speeds up 3D gaming by not rendering the parts of a scene that are obscured by other objects

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BY JON PHILLIPS

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Memorandum: Y2K Disaster-Response Plan
To: Intel High-Security Ops, Clearance Level 6
From: Altoid Sucking Man

CONFIDENTIAL

Dear Co-worker,

As a Level 6 Security Op, you're already well aware that 97% of the world's computers will crash at midnight on Jan. 1, 2000, causing widespread water shortages, power blackouts, and bank failures. Our own disaster-scenario modeling indicates the entire Silicon Valley area will be overwhelmed by looting, rioting, and pillaging, as civility dissolves into bedlam. Amid this chaos, you will be asked to lead Intel's most coveted properties to safety. All silicon and PCB schematics must reach our secret underground facility on the Nevada border by no later than 13:00 on Jan 2. Security team assignments are as follows:

- Security Team B will transport the Kinko, Krusty, and Chuckles CPU designs.
- Security Team C will transport the Bozo, Pennywise, and Gacy chipset designs.
- Security Team D will transport the Koko, Pagliacci, and Shaggy 2 Dope motherboard designs.

Security Team A will be responsible for ushering Dr. Von Hauf Brau to the Nevada facility. As Chief Architect of Manipulative Pricing Decisions, Dr. Von Hauf Brau is a priority-one security transfer. He is central to Intel's success during tumultuous times, and *must* reach Nevada safely. (Dr. Von Hauf Brau will also carry with him all 22 instructions of the Clarabell New Instructions set, for anyone in the Nevada facility who cares about that kind of stuff. The instructions will be written down on the back of a party invitation, and stuffed in the doctor's pipe tobacco pouch. Security Team members are advised to make sure the doctor doesn't inadvertently smoke an integral part of the company's roadmap.)

Please be advised that while most Intel employees will have their own Disaster-Response Plans, no evacuation measures have been prepared for temporary workers and the Merced team. When the alarm bells sound at 11:58 p.m., Dec. 31, you are advised to quickly walk past these expendables. Cover your face with some loose papers so you won't have to look them in the eye, and wave them off if they appear to be following you. If a desperate employee addresses you directly, respond by saying, "No time to speak right now, heh, heh… Ball's about to drop, heh, heh… and Happy New Year's to you, my friend, a Happy New Year's to all!"

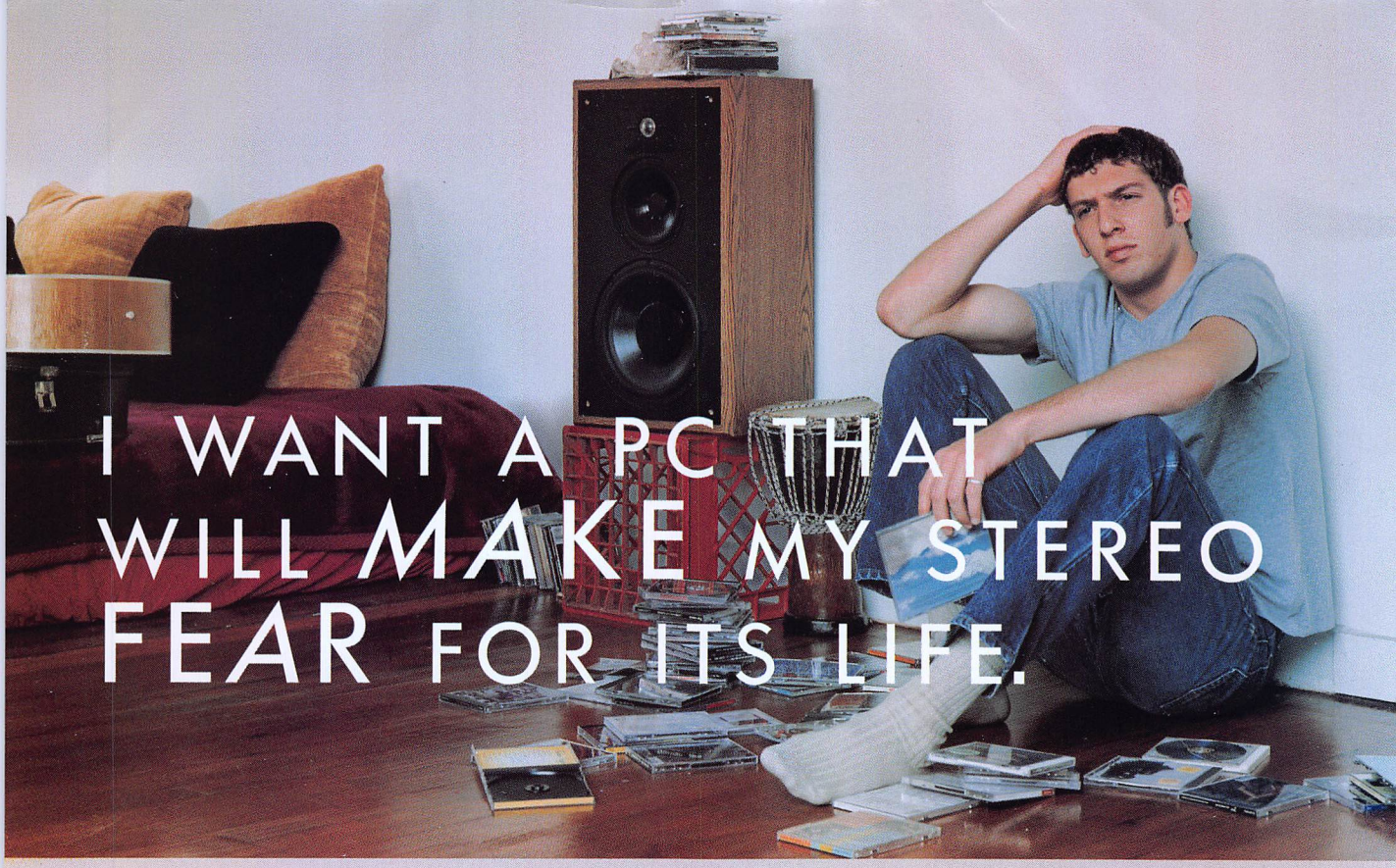
As your team travels from Santa Clara to the secret facility, be on the lookout for AMD guerillas and local indigenous greenie sympathizers (there may not be a more cunning warrior than the AMD greenie symp). In the immediate Santa Clara area, you should also keep your eyes peeled for gangs of high-tech workers seeking to avenge the loss of their stock option records. They'll be stripped down to their Gap khakis, wearing tribal face paint, and wielding cheap plastic *Star Wars* weaponry. As these "weapons" are merely children's toys, feel free to shoot the mobs on sight without fear of return fire.

It goes without saying that you are advised *not* to use air travel as you escape to safer ground. Intel research indicates that safety devices in most commercial airliners will be hard-hit by the Y2K bug, and you can altogether count out any semblance of "air traffic control."

I wish you godspeed, noble Intel soldiers. During the Y2K evacuation, I will of course remain in the shadows, sucking my Altoids, wrestling with my personal demons, and waiting for the release of Intel 820, may God have mercy on its tortured soul.

Respectfully,

Altoid Sucking Man



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$2199 [33] $66/Mo., 48 Month Purchase Plan
E-VALUE CODE: **89344-501021s**

Upgrade your ears:
■ 20.4GB[4] Ultra ATA Hard Drive (7200 RPM), add $84 ■ Sony 4x/2x/24x CD-RW Drive, add $199 ■ RIO 500 Portable Digital Audio Player, add $269

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[33]48-Mo. Purchase Plan offered through Dell Financial Services L.P., 14050 Summit Dr., Austin, TX 78728, to qualified consumers. Only available in the 50 U.S. states and District of Columbia, except AR & MN. Availability may be limited or offer may vary in some states. Advertised payments are based on sales prices depicted for 48-mo. term at 18.99% APR, with approved credit. Excludes taxes & shipping charges which vary (For example, based on sales price of $2199 for a desktop system, the total of sales taxes and shipping charges via 3- to 5-day ground to Hartford City, IN would be $204.95 [includes sales taxes of $109.95 and shipping charges of $95.00].). Taxes and shipping charges due with 1st payment unless ed in the amount financed, in which case your monthly payment will be higher.

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NEW DELL® *INSPIRON*™ 7500 Notebook

Mobile Desktop

- Intel® Pentium® II Processor at 400MHz
- 15" SXGA+ Active Matrix Display
- 64MB SDRAM ■ 10GB[4] Ultra ATA Hard Drive
- Removable Combo 24X Max[7] Variable CD-ROM and Floppy Drive
- 2X AGP 8MB ATI RAGE Mobility™-P 3D Video
- 3D Positional Sound with Wavetable
- Internal PCI 56K Capable[11] v.90 Fax Modem
- *NEW* 1-Year Dellnet℠ Internet Access[14] with 20MB of Online Backup[15]

$2979 $89/Mo., 48 Month Purchase Plan[33]
E•VALUE CODE: **89345-801029f**

Dell Recommended Upgrade:

- Removable Combo 6X[10] Max Variable DVD-ROM add $169
- Removable Iomega ZIP 100MB Drive for MegaBay, add $139
- Port Replicator, add $159

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NEW DELL® *INSPIRON*™ 7500 Notebook

Mobile Desktop

- Intel® Celeron™ Processor at 466MHz
- 15" XGA Active Matrix Display
- 96MB SDRAM
- 6.4GB[4] Ultra ATA Hard Drive
- Removable Combo 24X Max[7] Variable CD-ROM and Floppy Drive
- 2X AGP 8MB ATI RAGE Mobility™-P 3D Video
- 3D Positional Sound with Wavetable
- Internal PCI 56K Capable[11] v.90 Fax Modem

$2599 $78/Mo., 48 Month Purchase Plan[33]
E•VALUE CODE: **89345-801025**

Dell Recommended Upgrade:

- 128MB SDRAM, add $99
- *NEW* 1-Year Dellnet℠ Internet Access[14] with 20MB of Online Backup,[15] add $129
- Deluxe Nylon Carrying Case, add $39

NEW DELL® *INSPIRON*™ 3700 Notebook

Lightweight, Light Price

- Intel® Pentium® II Processor at 400MHz
- 14.1" XGA Active Matrix Display
- 64MB SDRAM ■ 4.8GB[4] Ultra ATA Hard Drive
- Modular 24X Max[7] Variable CD-ROM
- 2X AGP 8MB ATI RAGE Mobility™-M1 3D Video
- 3D Positional Sound with Wavetable
- 56K Capable[11] v.90 WinModem PC Card with XJACK
- *NEW* 1-Year Dellnet℠ Internet Access[14] with 20MB of Online Backup[15]
- Custom leather case

$2699 $81/Mo., 48 Month Purchase Plan[33]
E•VALUE CODE: **89345-801026q**

Dell Recommended Upgrade:

- Upgrade to 6.4GB[4] Hard Drive, add $99
- Hasbro Interactive Family Gaming Bundle,[22] add $79
- HP® DeskJet® 895, add $299

NEW DELL® *INSPIRON*™ 3700 Notebook

Lightweight, Light Price

- Intel® Celeron™ Processor at 433MHz
- 14.1" XGA Active Matrix Display
- 32MB SDRAM
- 4.8GB[4] Ultra ATA Hard Drive
- Modular 24X Max[7] Variable CD-ROM
- 2X AGP 8MB ATI RAGE Mobility™-M1 3D Video
- 3D Positional Sound with Wavetable

$1999 $60/Mo., 48 Month Purchase Plan[33]
E•VALUE CODE: **89345-801019**

Dell Recommended Upgrade:

- 56K Capable[11] v.90 WinModem PC Card with XJACK
- 64MB SDRAM

Add $189 E•VALUE CODE: 89345-801021c

All Inspiron Notebooks include: MS Works Suite 99 Software

- **McAfee VirusScan 4.02 ■ MS Windows® 98 SE**
- **Lithium Ion Battery ■ Inspiron Set-up Video**
- **3-Year Limited Warranty[2]**

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NEW DELL® *DIMENSION*® XPS B600*

Cutting Edge Performance

- Intel® Pentium® III Processor at 600BMHz ■ 512KB Integrated L2 Cache
- 64MB PC800 RDRAM at 400MHz ■ 13.6GB[4] Ultra ATA Hard Drive (7200 RPM)
- 17" (16.0" viewable, .26dp) M780 Monitor
- *NEW* 32MB NVIDIA TNT2 M64 4X AGP Graphics
- *NEW* 8X Max[10] Variable DVD-ROM Drive
- *FREE* Upgrade to NEW SB Live! Value Digital with MusicMatch Jukebox Enhanced software offer
- harman/kardon HK-195 Speakers
- 3Com® USRobotics v.90 PCI Telephony WinModem[11]
- *NEW* 1-Year Dellnet℠ Internet Access[14] with 20MB of Online Backup[15]

$2199 $66/Mo., 48 Month Purchase Plan[33]
E•VALUE CODE: **89345-501021a**

Dell Recommended Upgrade:

- *NEW* Microsoft Natural Keyboard Pro, Dell Edition
- Sony 4x/2x/24x CD-RW Drive ■ Altec Lansing ACS-340 Speakers with Subwoofer

Add $299 E•VALUE CODE: 89345-501024u

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The Dell4me total ownership experience; a complete resource for products and services that make it easy for you to get the most out of technology.

SOFTWARE: Dell offers a variety of software multipacks designed for work, education or play. ■ Fast Track Game 5-Pack, featuring Star Wars Rogue Squadron, $99 ■ Quicken Power 3-Pack, $79 ■ Choose from one of four Education Packs, $79

PRINTERS: Dell simplifies your life and ensures compatibility by pre-installing printer drivers[35] on your new Dell PC. ■ HP 895 Printer, $299 ■ Other brands and models available, starting at $129

CAMERAS AND *SCANNERS*: Dell offers you the tools you need to take pictures and archive images on your hard drive instead of in a shoebox. Send pictures and video to friends and family via e-mail. ■ HP 4200 Cse ScanJet, $199 ■ Logitech® Digital QuickCam® Home Video Camera, $99 ■ Fuji MX1200, $299

SERVICE AND *SUPPORT*: Dell offers you the help you need when you need it, via phone or online. ■ 24x7 phone and online tech support ■ Premier 3-Year At-Home Service[3], add $99 ■ Support.dell.com for innovative online support tools

INTERNET ACCESS AND *SERVICES*: Dell offers you access to the Internet as well as online services and resources designed to help you make the most of your PC. ■ Dellnet℠ Internet access[14] with 20MB Online Backup[15] ■ Simple drag and drop website creation tool with 12MB storage ■ Over $100 worth of special offers for Dell customers with popular online retailers.

PAYMENT *SOLUTIONS*: Dell offers several payment options designed to fit a wide range of customer needs. ■ Dell Platinum Visa® ■ 48-Month Purchase Plan[33] ■ E-Check (automatic checking withdrawal)

NEW DELL® *DIMENSION*® XPS B533*

Cutting Edge Performance

- Intel® Pentium® III Processor at 533BMHz
- 64MB PC700 RDRAM at 356MHz
- 512KB Integrated L2 Cache
- 13.6GB[4] Ultra ATA Hard Drive (7200 RPM)
- 17" (16.0" viewable, .26dp) M780 Monitor
- *NEW* 32MB NVIDIA TNT2 M64 4X AGP Graphics
- *NEW* 48X Max[8] Variable CD-ROM Drive
- *FREE* Upgrade to *NEW* SB Live! Value Digital with MusicMatch Jukebox Enhanced software offer
- harman/kardon HK-195 Speakers
- 3Com® USRobotics v.90 PCI Telephony WinModem[11]
- *NEW* 1-Year Dellnet℠ Internet Access[14] with 20MB of Online Backup[15]

$1799 $54/Mo., 48 Month Purchase Plan[33]
E•VALUE CODE: **89345-501017**

Dell Recommended Upgrade:

- *NEW* 32MB Diamond Viper V770D NVIDIA "Ultra" 4X AGP Graphics Card
- *NEW* 8X Max[7] Variable DVD ROM Drive
- 100MB Zip Drive with One Disk

Add $279 E•VALUE CODE: 89345-501020u

DELL® *DIMENSION*® XPS T450

High Performance, Great Value

- Intel® Pentium® III Processor at 450MHz
- 64MB 100MHz SDRAM ■ 512KB Integrated L2 Cache
- 6.4GB[4] Ultra ATA Hard Drive
- 17" (16.0" viewable, .26dp) M780 Monitor
- 16MB 3DFX Voodoo3 3000D AGP Graphics Card
- 40X Max[6] Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- v.90 PCI DataFax Modem[11]
- *NEW* 1-Year Dellnet℠ Internet Access[14] with 20MB of Online Backup[15]

$1299 $39/Mo., 48 Month Purchase Plan[33]
E•VALUE CODE: **89345-501012**

Dell Recommended Upgrade:

- 32MB Diamond Viper 770D NVIDIA AGP Graphics
- Turtle Beach Montego II A3D™ 320V Sound Card
- *NEW* Harman Kardon HK-595 Surround Sound Speakers with Subwoofer

Add $219 E•VALUE CODE: 89345-501015u

DELL® *DIMENSION*® L400c

Affordable Desktop Solution

- Intel® Celeron™ Processor at 400MHz
- 32MB 100MHz SDRAM ■ 128KB Integrated L2 Cache
- 4.3GB[4] Ultra ATA Hard Drive
- *NEW* 15" (13.8" viewable) M570 Monitor
- Intel 3D AGP Graphics
- 40X Max[6] Variable CD-ROM Drive
- SoundBlaster 64V PCI Sound Card
- harman/kardon HK-195 Speakers
- v.90 PCI DataFax Modem[11]
- *NEW* 1-Year Dellnet℠ Internet Access[14] with 20MB of Online Backup[15]

$899 $27/Mo., 48 Month Purchase Plan[33]
E•VALUE CODE: **89345-501008**

Dell Recommended Upgrade:

- 64MB 100MHz SDRAM
- 6.4GB[4] Ultra ATA Hard Drive
- 17" (16.0" viewable, .26dp) M780 Monitor

Add $159 E•VALUE CODE: 89345-501010u

All Dimension systems include:

- **Keyboard ■ MS Works Suite 99 Software**
- **Mouse ■ McAfee VirusScan 4.02**
- **3.5" Floppy ■ MS Windows® 98 SE**
- **3-Year Limited Warranty[2]**
- **1-Year At-Home Service[3]**

*Please contact your sales representative for more information as estimated ship dates will exceed 30 days.

Pricing not discountable. Prices and specifications valid in U.S. only and subject to change without notice. [2]For a complete copy of Guarantees or Limited Warranties, write Dell USA L.P., Attn: Warranties, One Dell Way, Round Rock, TX 78682. [3]At-home or on-site service provided via service contract between customer and third-party provider, and is not available in certain remote areas. Technician dispatched if necessary pursuant to phone-based troubleshooting with technical support personnel. [4]For hard drives, GB means 1 billion bytes; total accessible capacity varies depending on operating environment. [5]17X Min. [7]10X Min. [8]20X Min. [10]2.5X Min. [11]Download speeds limited to 53Kbps. Upload speeds are less (in the 30Kbps range) and vary by modem manufacturer. Speeds also vary depending on line conditions. Analog phone line and compatible server equipment required. [14]Includes 150 hours Internet access per month, with $1.50 per hour charge for each hour (or fraction thereof) over 150 hours. Remote subscribers subject to additional charge of $4.95 for each hour of Dellnet service. Excludes applicable taxes and local/long distance telephone access fees or charges. Additional $1.00/hour surcharge for Dellnet service in HI and AK. [15]Online backup services are provided by a third party, and such services are provided subject to terms and conditions between such third party and the customer. Limited to 20MB online storage; additional storage space available at additional charge. Dell disclaims any responsibility for lost customer data. [33]Software, packaging and documentation differ from retail versions. [35]For select Hewlett Packard printers. Intel, the Intel Inside logo and Pentium are registered trademarks and Celeron is a trademark of Intel Corporation. MS, Microsoft, IntelliMouse and Windows are registered trademarks of Microsoft Corporation. 3Com is a registered trademark of 3Com Corporation. HP and DeskJet are registered trademarks of Hewlett Packard Corporation. ©1999 Dell Computer Corporation. All rights reserved.

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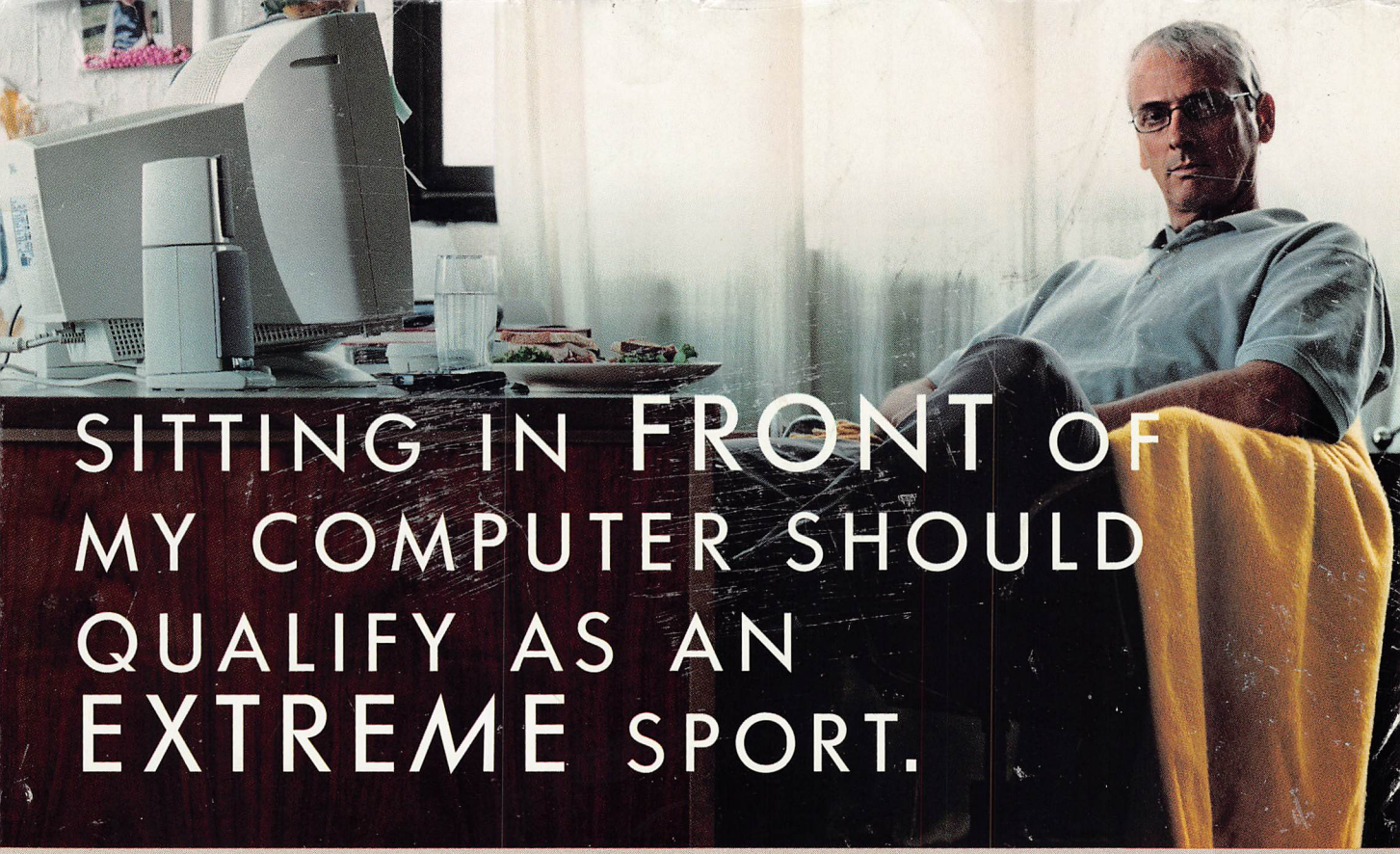

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Your heart beats like an overheated jackhammer. Sweat forms on your forehead. Your dilated left eye twitches. It's just another normal afternoon sitting in front of your Dimension® XPS B Series Desktop. It's normal because the new motherboard on this system, combined with RDRAM, offers up to a 166% performance gain over earlier systems. The result: stunningly impressive streaming multimedia and awesome 3D graphics. And when you log on, you'll find that everything is faster, smoother, more incredible and more intense. This latest technology is one more benefit of the Dell4me total ownership experience. A complete resource for products and services that make it easy for you to get the most out of technology.

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- Intel® Pentium® III Processor at 533BMHz ■ 64MB PC700 RDRAM at 356MHz ■ 512KB Integrated L2 Cache
- 13.6GB[4] Ultra ATA Hard Drive (7200 RPM) ■ 17" (16.0" viewable, .26dp) M780 Monitor
- *NEW* 32MB NVIDIA TNT2 M64 4X AGP Graphics ■ *NEW* 48X Max[5] Variable CD-ROM Drive
- Crystal 128V Integrated Audio Accelerator
- harman/kardon HK-195 Speakers ■ 3Com® USRobotics v.90 PCI Telephony WinModem[11]
- *NEW* 1-Year Dellnet℠ Internet Access[14] with 20MB of Online Backup[15]
- Take a virtual tour of this system online at www.dell.com/btour
- 3-Year Limited Warranty[2] ■ 1-Year At-Home Service[3]

$1799 $54/Mo., 48 Month Purchase Plan[33]
E-VALUE CODE: **89343-501017m**

- Free Upgrade from[37] Crystal 128V Integrated Audio Sound to New SB Live! Value Digital Sound Card ■ See www.dell.com for additional promotional offers

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